Information and Communication Technology

Grade 11

Educational Publications Department



To obtain electronic textbooks, visit
www.edupub.gov.lk

First Print	-	2015
Second Print	-	2016
Third Print	-	2017
Fourth Print	-	2018
Fifth Print	-	2019

All Rights Reserved

ISBN 978-955-25-0326-9

Published by Educational Publications Department
Printed by Saraswathi Publications,
No. 2/60, Circular Road, Divulapitiya.

The National Anthem of Sri Lanka

Sri Lanka Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Sundara siri barinee, surendi athi sobamana Lanka
Dhanya dhanaya neka mal palaturu piri jaya bhoomiya ramya
Apa hata sepa siri setha sadana jeewanaye matha
Piliganu mena apa bhakthi pooja Namo Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Oba we apa vidya
Obamaya apa sathya
Oba we apa shakthi
Apa hada thula bhakthi
Oba apa aloke
Apage anuprane
Oba apa jeevana we
Apa mukthiya oba we
Nava jeevana demine, nithina apa pubudukaran matha
Gnana veerya vadawamina regena yanu mana jaya bhoomi kara
Eka mavakage daru kela bevina
Yamu yamu vee nopama
Prema vada sema bheda durerada
Namo, Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha

අපි වෙමු එක මවකගෙ දරුවෝ
එක නිවසෙහි වෙසෙනා
එක පාටැති එක රුධිරය වේ
අප කය තුළ දුවනා

එබැවිනි අපි වෙමු සොයුරු සොයුරියෝ
එක ලෙස එහි වැඩෙනා
ජීවත් වන අප මෙම නිවසේ
සොඳින සිටිය යුතු වේ

සැමට ම මෙත් කරුණා ගුණෙනී
වෙළී සමගි දමිනී
රන් මිණි මුතු නො ව එය ම ය සැපතා
කිසි කල නොම දිරනා

ආනන්ද සමරකෝන්

ஒரு தாய் மக்கள் நாமாவோம்
ஒன்றே நாம் வாழும் இல்லம்
நன்றே உடலில் ஓடும்
ஒன்றே நம் குருதி நிறம்

அதனால் சகோதரர் நாமாவோம்
ஒன்றாய் வாழும் வளரும் நாம்
நன்றாய் இவ் இல்லினிலே
நலமே வாழ்தல் வேண்டுமன்றோ

யாவரும் அன்பு கருணையுடன்
ஒற்றுமை சிறக்க வாழ்ந்திடுதல்
பொன்னும் மணியும் முத்துமல்ல - அதுவே
யான்று மழியாச் செல்வமன்றோ.

ஆனந்த சமரக்கோன்
கவிதையின் பெயர்ப்பு.



Being innovative, changing with right knowledge
Be a light to the country as well as to the world.

Message from the Hon. Minister of Education

The past two decades have been significant in the world history due to changes that took place in technology. The present students face a lot of new challenges along with the rapid development of Information Technology, communication and other related fields. The manner of career opportunities are liable to change specifically in the near future. In such an environment, with a new technological and intellectual society, thousands of innovative career opportunities would be created. To win those challenges, it is the responsibility of the Sri Lankan Government and myself, as the Minister of Education, to empower you all.

This book is a product of free education. Your aim must be to use this book properly and acquire the necessary knowledge out of it. The government in turn is able to provide free textbooks to you, as a result of the commitment and labour of your parents and elders.

Since we have understood that the education is crucial in deciding the future of a country, the government has taken steps to change curriculum to suit the rapid changes of the technological world. Hence, you have to dedicate yourselves to become productive citizens. I believe that the knowledge this book provides will suffice your aim.

It is your duty to give a proper value to the money spent by the government on your education. Also you should understand that education determines your future. Make sure that you reach the optimum social stratum through education.

I congratulate you to enjoy the benefits of free education and bloom as an honoured citizen who takes the name of Sri Lanka to the world.

Akila Viraj Kariyawasam
Minister of Education

Foreword

The educational objectives of the contemporary world are becoming more complex along with the economic, social, cultural and technological development. The learning and teaching process too is changing in relation to human experiences, technological differences, research and new indices. Therefore, it is required to produce the textbook by including subject related information according to the objectives in the syllabus in order to maintain the teaching process by organizing learning experiences that suit to the learner needs. The textbook is not merely a learning tool for the learner. It is a blessing that contributes to obtain a higher education along with a development of conduct and attitudes, to develop values and to obtain learning experiences.

The government in its realization of the concept of free education has offered you all the textbooks from grades 1-11. I would like to remind you that you should make the maximum use of these textbooks and protect them well. I sincerely hope that this textbook would assist you to obtain the expertise to become a virtuous citizen with a complete personality who would be a valuable asset to the country.

I would like to bestow my sincere thanks on the members of the editorial and writer boards as well as on the staff of the Educational Publications Department who have strived to offer this textbook to you.

W. M. Jayantha Wickramanayaka,
Commissioner General of Educational Publications,
Educational Publications Department,
Isurupaya,
Battaramulla.
2019.04.10

Monitoring and Supervision

W. M. Jayantha Wickramanayaka	Commissioner General of Educational Publications Educational Publications Department

Direction

W. A. Nirmala Piyaseeli	Commissioner (Development) Educational Publications Department

Co-ordination

Dakshina Kasturiarachchi	Assistant Commissioner Educational Publications Department

Editorial Board

Professor Sanath Jayasena	Associate Professor, Department of Computer Science and Engineering, University of Moratuwa, Katubedda, Moratuwa
Dr. Prasad Wimalaratne	Senior Lecturer, Head of the Department, Department of Communication and Media Technologies, University of Colombo School of Computing, Colombo 07
Dr. H. L. Premarathna	Senior Lecturer, University of Colombo School of Computing, Colombo 07
G. M. Niel Gunadasa	Director of Education, ICT Branch, Ministry of Education, Isurupaya, Battaramulla
K. G. S. K. Perera	Senior Lecturer, Department of Information Technology, Faculty of Science and Technology, National Institute of Education, Maharagama
Dakshina Kasturiarachchi	Assistant Commissioner Educational Publications Department

Writer Board

Vineeta Goonetilleke	Lecturer, Sri Lanka Institute of Information Technology, Malambe
G. K. N. S. Jeewanthi Perera	Visiting Lecturer, University of Kelaniya, Kelaniya
A. Sunil Samaraweera	Center Manager, Zonal Computer Resource Center, Kegalle

I. R. N. H. Karunarathna	Center Manager, Zonal Computer Resource Center, President's College, Maharagama
K. V. S. M. Mohanlal	Computer Instructor, Zonal Computer Resource Center, Deniyaya Central College, Deniyaya
E. G. W. Jayasuriya	Computer Instructor, Zonal Computer Resource Center, Sri VijayaramaVidyalaya, Udahamulla, Nugegoda
P. J. K. Kahagalle	Computer Instructor, Zonal Computer Resource Center, President's College, Maharagama
B. A. N. D. Samarasingha	Teacher Service, Royal College, Colombo 07

Language Editing

K. D. D. Percival	Retired Senior Lecturer, Teachers' Training College, Maharagama

Cover Page

Chaminda Hapuarachchi	Educational Publications Department

Technical Assistance

P. A. D. Nisansala Sandamali	Educational Publications Department

Index

1 Programming

After studying this chapter, you will understand the following:

- How to analyze a problem and develop an algorithm
- Control structures and their use
- Drawing flow charts, writing pseudo codes and conversions between them
- Finding alternate solutions to a problem
- Programming in Pascal
- Evolution of programming languages

1.1 Analyzing a problem

The raw materials that are used to solve a problem are known as the 'input'. The result obtained after solving a problem is known as the 'output'. Converting input to output is called the 'process'. A process takes place step by step and it is very important to understand the order of the process. When analyzing a problem, the input, process and output are identified separately.

Example -

Problem 1 : Preparing a letter which can be posted.

Input : A sheet of paper suitable to write the letter on and a pen
An envelope and a stamp
Glue

Process :
1. Writing the letter
2. Folding the letter and putting it into the envelope
3. Pasting the envelope
4. Writing the recipient's address on the envelope
5. Sticking the stamp



Output : A letter ready to be posted.

Note: Steps No. 4 and 5 in this process can be interchanged. However, the other steps should be followed in the order indicated.

Problem 2 : Making a cup of tea



Input : Tea leaves, sugar, hot water

Process :
1. Putting tea leaves in the strainer
2. Pouring hot water to the cup through the strainer
3. Adding some sugar to the cup
4. Stirring it well with a spoon
5. Testing for taste, taking a small sip from the cup
6. If the taste is not satisfactory, go to step 3 and repeat step Nos. 4 and 5

Output : A cup of tea

Problem 3 : Dividing 40 page and 80 page books from a parcel of books between two siblings - Sanduni and Anupama.

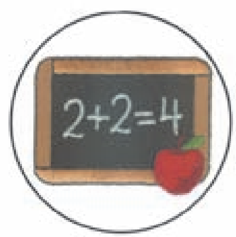


Input : The parcel of books

Process :
1. Opening the book parcel
2. Taking a book out from the parcel
3. If it is a 40 page book, giving it to Sanduni
4. If it is a 80 page book, giving it to Anupama
5. Go to Step No. 2 till all the books are taken out of the parcel

Output : Sanduni getting 40 page books
Anupama getting 80 page books

Problem 4 : Adding two numbers

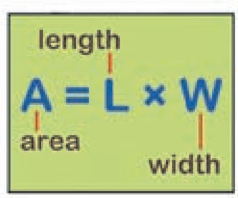


Input : Two numbers

Process : Adding the two numbers

Output : Total

Problem 5 : Finding the area of a rectangle



Input : Length and width of the rectangle

Process : Area = Length x Width

Output : Area

Problem 6 : Finding the larger number between two numbers

Input : Two numbers

Process : Comparing the two numbers, finding the larger one

Output : Larger number

Problem 7 : Finding whether a number is odd or even



Input : Number

Process : Dividing the number by 2

Deciding that the number is even if the remainder = 0

Deciding that the number is odd if the remainder = 1

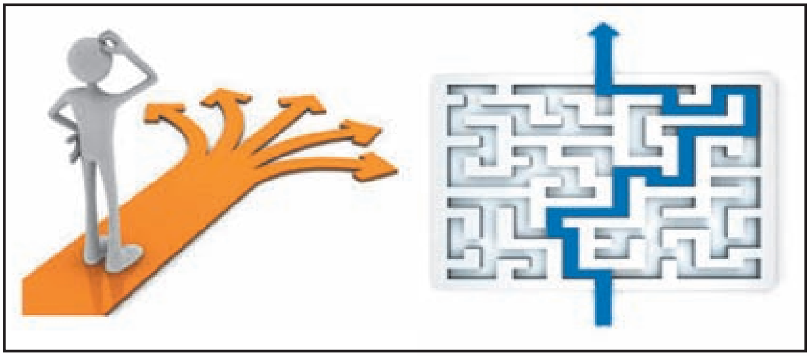
Output : Indicating whether the number is odd or even

Activity

1. Identify the input, process and output related to dividing 100 toffees among 20 people.
2. Identify the input, process and output in making a kite.

What are alternative solutions?

If there is more than one solution to a given problem, such solutions are called alternative solutions. Such solutions depend on the nature of the problem.



Example

Imagine you come to school by school bus. If the bus breaks down on your way to school, you certainly will think of other alternative ways to reach school. Thus, you will think of **alternative solutions** to reach school.

1. Coming to school by another school bus which goes to your school
2. If you have money, reaching the school by CTB or private bus
3. Walking to school along the road
4. Walking to school using a short-cut
5. If you have a way to inform your parents, get their support to reach the school
6. Reaching the school by car or motor bike with the support of a trustworthy person

You may select a good solution out of these if it is mandatory to go to school that day.

Thus, if there are many solutions (set) to a particular problem, it is suitable to consider these and select an appropriate solution.

All the solutions pertaining to a problem are called **solution space**. In computer programming also, various solutions should be identified and an appropriate solution should be selected. Then, we can create a short, simple program.

Example 1

Let us examine the solution space to find the perimeter of a rectangle.

Let us analyze the input, process and output related to this problem.

Input : Length and width of the rectangle

Process : Calculating the perimeter

Output : Indicating the perimeter

Let us examine the solution space to calculate the perimeter.

1st solution	Perimeter = length + width + length + width
2nd solution	Perimeter = length × 2 + width × 2
3rd solution	Perimeter = (length + width) × 2

Out of these solutions, a person who has knowledge only of addition, can select the 1st solution as the most appropriate. A person who has knowledge of multiplication and addition can select the 3rd solution out of the 2nd and 3rd solutions as the most appropriate. The reason for this is, it has the minimum number of additions and multiplications.

Example 2

Indicating that a student has failed if the score for the ICT Subject is less than 35, and indicating pass if the score is 35 or above.



Input **:** Marks

Process **:** Comparing the mark scored with 35

Solution 1. If the mark is less than 35

Result = Fail

If not

Result = Pass

Solution 2. If the mark is 35 or more than 35

Result = Pass

If not

Result = Fail

Output **:** Fail or Pass

Example 3

Finding the larger number from the given two numbers *(See problem 6 in page 3)*

Let us consider the two input numbers as *n1* and *n2*.

Solution 1. If *n1* is larger than *n2*, the larger number will be *n1*.

If *n2* is larger than *n1*, the larger number will be *n2*.

Solution 2. Subtract *n2* from *n1*.

If the result is more than *0*, *n1* is the larger number.

If the result is less than *0*, *n2* is the larger number.

Thus, it is important to select the appropriate solution out of the available alternative solutions.

1.2 Problem Solving using Algorithms

An algorithm is a method to show the steps in solving a problem. An algorithm is a step-by-step procedure for solving a problem. The need for this is to present a way to solve the problem with a plan.

Example 1 - Let us develop an algorithm to post a letter.



(1) Writing the letter

(2) Folding the letter

(3) Inserting the letter in an envelope

(4) Writing the address

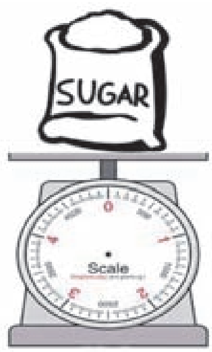
(5) Sticking the stamp

(6) Posting the letter

Step (1), (2) and (3) in this algorithm should be followed in the given order. Step (4) and (5) can be interchanged. The reason for this is, you can either stick the stamp after writing the address or write the address after sticking the stamp.

Thus, there are steps in an algorithm which should be followed in a strict sequential order. Sometimes, if the order of some steps is changed, it does not affect the process and the output is same.

Example 2 - Let us consider steps in measuring 500g of sugar using a scale.



(1) Putting sugar into a bag

(2) Placing the bag on the scale and getting the reading on the scale

(3) If the weight of the sugar is less than 500g, add sugar till it weighs 500g

(4) If the weight of the sugar is more than 500g, remove sugar from the bag till it weighs 500g

(5) Remove the bag of sugar from the scale when the weight is 500g

The algorithm to measure 500g sugar is given above.

Activity



There are 183 students in a primary school. The principal has decided to hold an inter-house sports meet dividing them into three houses – Olu, Nelum and Manel. Develop an algorithm to the divide the students into the three houses.

1.2.1 Control Structures

Three types of control structures are used in an algorithms.

i. **Sequence** 

ii. **Selection** 

iii. **Repetition** 

i. Sequence

If the steps from the beginning to the end of an algorithm are carried out in a strict order, it is called a sequence.

Example -



1. Climbing up or down step by step when going on a staircase
2. Students who were admitted to grade 1 of the school continue studies till grade 13

Activity



Write down two incidents which consist of sequences.

ii. Selection

Selection is a situation where step(s) are executed depending on whether a condition of an algorithm is satisfied or not. There are two choices; if the condition is satisfied, one is selected and if it is not satisfied, the other selection is selected.

Examples of selection

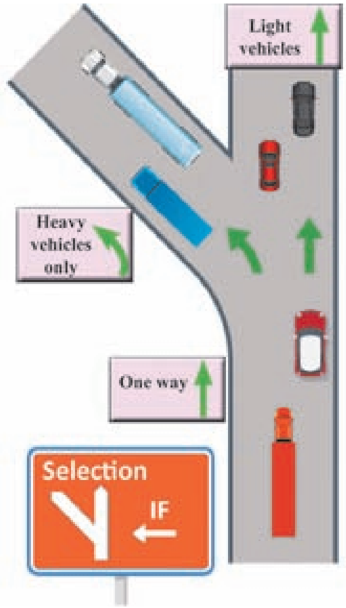
1. Admitting a child to Grade 1:

   If a child is below 5 years as at 31st of January that year

   The child cannot be admitted to school

   If not

   The child can be admitted to school



2. Passing a subject:

   If the mark is 35 or more

   It is a Pass

   If not

   It is a Fail

3. Buying a book:

   If you have money equal to or more than the price of the book

   You can buy the book

   If not

   You cannot buy the book

Activity

1. Write down three incidents which consist of selection.
2. If a Sri Lankan citizen gets the right to vote after completing the age of 18, select the most suitable word for the blanks given below.

   If the age is .... (more/less) than 18

   The vote .... (can/cannot) be casted

   If not,

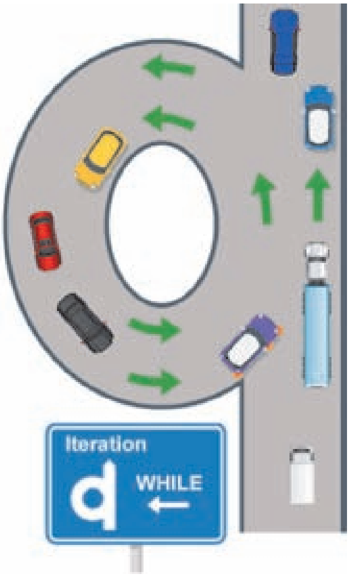
   The vote .... (can/cannot) be casted

iii. Repetition

If one or several steps of an algorithm are repeated until a condition is satisfied, it is called repetition.

Examples

1. Let us consider the process of a class teacher marking the attendance register.
   - (1) Call the first name on the register
   - (2) Mark 1 if the student is present
   - (3) Mark 0 if the student is absent
   - (4) Call the name of the next student
   - (5) Repeat step (2) or (3) and (4) till the last name of the register is called



2. Let us consider the process of reading a paragraph and calculating the number of words you read.
   - (1) Read the first word of the paragraph
   - (2) Number of words = 1
   - (3) Read the next word
   - (4) Add 1 to the number of words
   - (5) Repeat step (3) and (4) till the end of the paragraph
   - (6) After reading the paragraph, indicate the number of words

Activity

1. Write down as steps, two scenario that comprise repetition.
2. Fill in the blanks below related to repetition that output 5 times from 5 to 60.
   - I. n = 5
   - II. Output the value of n.
   - III. Add 5 to the value of n.
   - IV. Repeat step number ……… and ……….. till the value of n = 60.

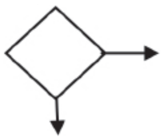
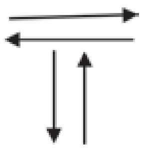
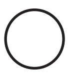
1.3 Representation of an algorithm

Flow charts and pseudo codes are used as tools to present an algorithm to make the algorithm understand better.

1.3.1 Flowcharts

Flowcharts are used to present how the algorithm is built step by step in a dramatic manner. The symbols given in table are used to indicate different functions. (See Table 1.1)

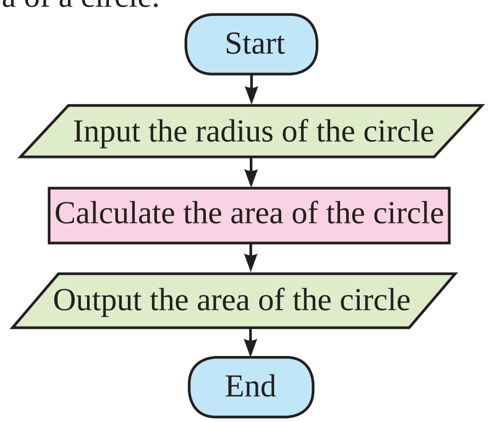
Table 1.1

Symbol	Function
	Start or end
	Input or output
	Process
	Decision
	Flow direction
	Connector

Sequence

In sequence the steps from the beginning to the end are executed in order.

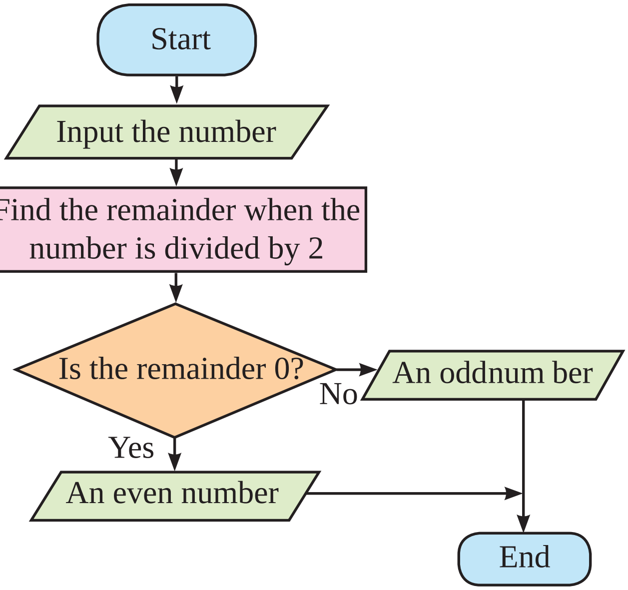
E.g. 1 - Finding the area of a circle.



Selection

The selection indicates the flow of direction depending on a condition being satisfied or not.

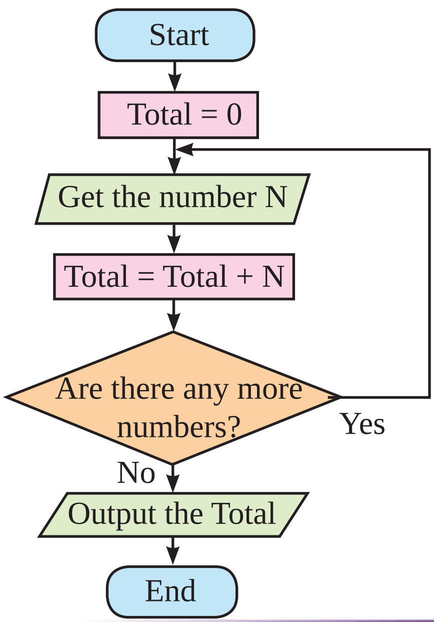
E.g. - Finding whether a number is odd or even



Repetition

A step or several steps are repeated till a condition is satisfied or are continued till it is satisfied.

E.g. - Finding the total of some numbers



Activity

Draw flow charts to solve the problems given below.

1. Find the perimeter and area of a rectangle.
2. It is decided to add Rs.5000 to the basic salary of the employees of a company. Calculate the new salary.
3. When posting a letter, postal fare is charged according to its weight. The standard fare should be paid for letters which are equal to or less than the standard weight. An additional fare should be charged if the weight is more than the standard weight.
4. Indicate the first 12 multiples of 7.
5. Draw flow charts for the examples in selection 1:2:1.

1.3.2 Pseudo codes

When an algorithm is presented in simple English terms it is called a pseudo code. Pseudo codes are independent of a computer language. Pseudo codes can be converted to any programming language instructions. Hence, pseudo codes make computer programming easier.

Let us see simple English terms used in an pseudo code.

BEGIN - To indicate a beginning

END - To indicate an end

INPUT , READ , GET - To indicate an input

OUTPUT, DISPLAY , SHOW - To show an output

PROCESS, CALCULATE - To indicate a process

IF … THEN .. .ELSE … ENDIF - Used to indicate a selection

FOR – DO
WHILE – ENDWHILE
REPEAT - UNTIL
} Used to indicate a repetition

Writing pseudo codes

E.g. 1 - Finding the area of a circle

```
BEGIN
        INPUT Radius
        CALCULATE Area = 22/7 × Radius × Radius
        DISPLAY Area
END.
```

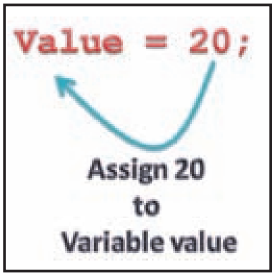
E.g. 2 - Finding whether a number is odd or even

```
BEGIN
    READ number as N
    CALCULATE  Remainder after number is divided by 2
    IF Remainder = 0 THEN
        DISPLAY "Even number"
    ELSE
        DISPLAY "Odd number"
    ENDIF
END.
```

E.g. 3 - Finding the total of some numbers

```
BEGIN
    Total = 0
    REPEAT
        READ Number as N
        CALCULATE Total = Total + N
    UNTIL numbers are over
    DISPLAY Total
END.
```

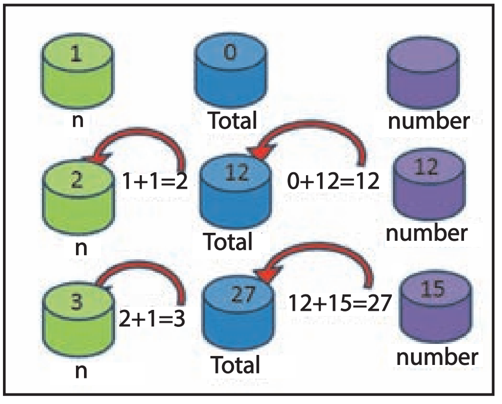
E.g. 4 - Finding the total and the average of 10 numbers




```
BEGIN
    Total = 0
    Average = 0
    n = 1
    WHILE n <= 10
        READ Number
        CALCULATE Total = Total + Number
        n = n + 1
    ENDWHILE
    CALCULATE Average = Total/(n - 1)
    DISPLAY Total, Average
END.
```

Following are some of the facts about the above pseudo code.

- Total, Average and Number are variables.
    - When values are assigned to number variable, the value of Total, Average and n variables change.
- n indicates the number of repetitions. (Number of times the loop is executed)
- The statements Total = 0 and Average = 0, makes starting values of these variables assigned as 0.
    - Hence, the initial value of Total and Average are 0s.
- The statement n = 1, makes the starting value of n is assigned to 1.
- n <= 10 is the condition that should be satisfied.
- WHILE n <= 10 indicates that the loop n should be repeated until value of n is 10.
    - Repetition occurs when the value of n is 10 or less than 10. This means, till the condition n <=10 is true, repetition occurs. When the value of n becomes 11, the repetition stops. Then the condition becomes false.
- READ denotes getting a value for Number variable.



- Total = Total + Number denotes the present value of Total is added to number and the resultant value is assigned on the new value of Total.
- n = n + 1 calculates the number of repetitions. 1 is added to the present value of n and the result is assigned to n.
- ENDWHILE indicates the limit to end repetition. Hence, only READ number, Total = Total + Number and n = n + 1 are repeated till the condition n <= 10 is fulfilled.
- When the repetition stops, the value of n is 11 and the condition is false.
- By Average = Total/(n - 1) , final value of Total is divided by (n – 1) and that value is assigned to Average variable.
- DISPLAY (Total, Average) produces the output of the total of 10 numbers and its average.

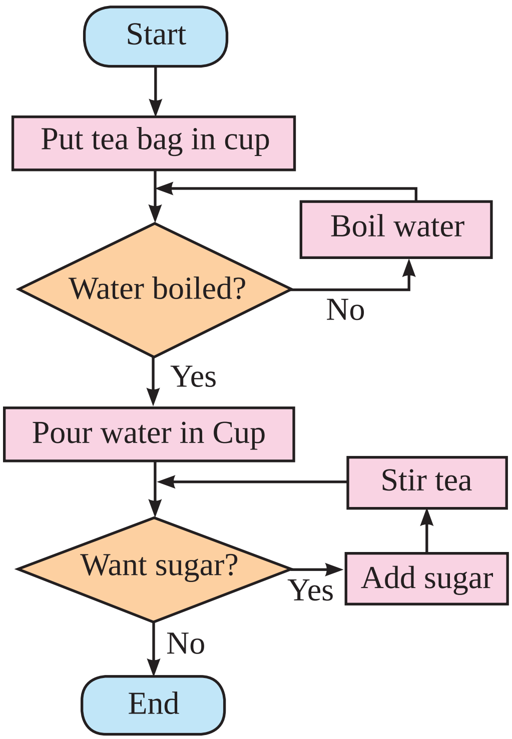
Observation



- When a value is assigned to a variable, the previous value is lost.
- When the statement Total = Total + Number is executed, the value assigned to the Number variable is added with the value assigned to Total variable and the result obtained is assigned to the Total variable.
- Total = Total + Number is not a mathematical formula.

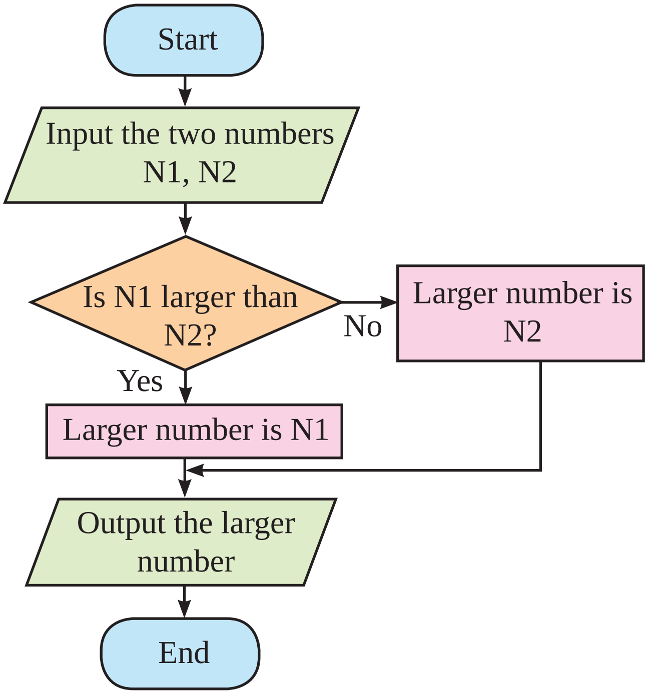
1.3.3 Converting flow charts to pseudo codes

An algorithm can be presented in a flow chart as well as in a pseudo code. Hence, let us examine how a flow chart can be converted to a pseudo code.



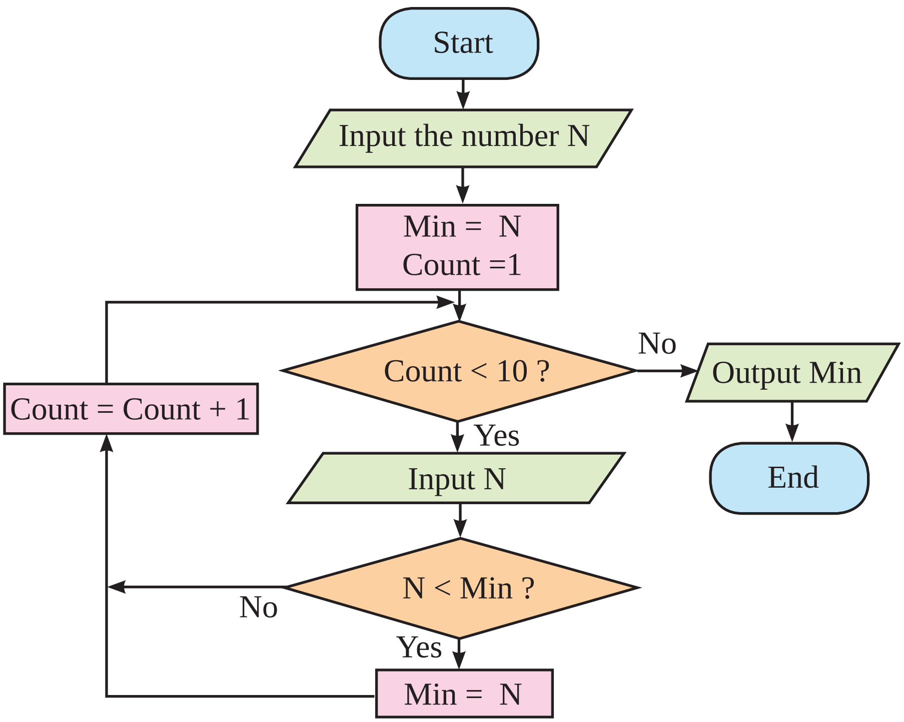

```
BEGIN
    Put tea bag in cup
    WHILE (not water boiled)
        Boil water
    ENDWHILE
    Pour water in cup
    WHILE (sugar needed)
        Add sugar
        Stir tea
    ENDWHILE
END
```

E.g. 1 - Finding the larger number from two different numbers




```
BEGIN
        READ N1, N2
        IF N1 > N2 THEN
                Large = N1
        ELSE
                Large = N2
        ENDIF
        DISPLAY Large
End.
```

E.g. 2 - Finding the smallest number from 10 input numbers

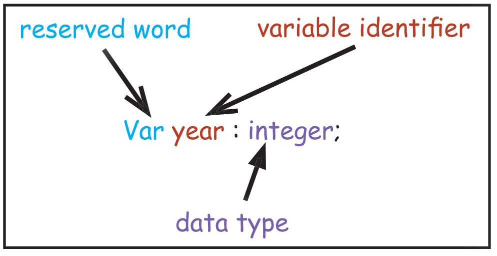


```
BEGIN
    INPUT Number as N
    Min = N
    Count = 1
    WHILE Count < 10
        OUTPUT Number as N
        IF N < Min  Then
            Min = N
        ENDIF
        Count = Count + 1
    ENDWHILE
    PRINT  Min
END.
```

1.4 Pascal programming

1.4.1 Identifiers

An identifier is a term used to represent a variable, constant or a program. The following are some rules that should be followed in declaring an identifier.



- Reserved words in Pascal cannot be used as an identifier name. In any programming language reserved words cannot be used as identifiers.

  E.g. - BEGIN, END are not valid
  (**E.g.** - A-Z, a-z)
- Should start with an English letter.
- After the first letter of the identifier, letters (a-z, A-Z) or numbers (0-9) and underscore (_) can be used.

  E.g. - Student_name
- Not case sensitive (**E.g.** - Art, art, ART will be the same identifier)
- There should not be any space between words.

  E.g. - Student Name - Not valid

- The special characters such as the following should not be included in an identifier.

  ~ ! @ # $ % ^ & * ( ) - + = { } [ ] : ; ‘ “ <> ? , . / | \

  but, only underscore (_) is valid.

- Use of meaningful terms for identifiers can make program easily understood.

  Examples of valid identifiers

  Sum, SUM, Total_Nos, Num1, FirstName, Last_Name

  Examples of identifiers that are not valid

  $75, Average Marks, 9A, Last-name

1.4.2 Reserved words

The reserved words in Pascal, are defined in Pascal language. Hence, reserved words are not used as identifiers.

Reserved words are different from language to language. The following are reserved words used in Pascal.

and	exports	mod	shr
asm	file	nil	string
array	for	not	then
begin	function	object	to
case	goto	of	type
const	if	or	unit
constructor	implementation	packed	until
destructor	in	procedure	uses
div	inherited	program	var
do	inline	record	while
downto	interface	repeat	with
else	label	set	xor
end	library	shl	ate
			to

1.4.3 Standard data types in Pascal

When a program is executed, the input and output should be stored in computer memory. The space needed for each is defined according to the data type. Hence, it is essential for a programmer to have knowledge of data types.

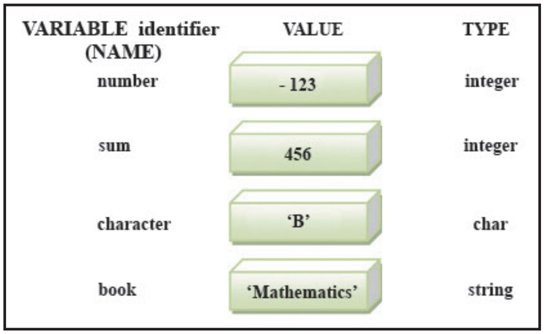
The following are data types and their ranges.

Integer - Plus or minus whole numbers

E.g. - 0, 46, -12

Real - Plus or minus decimal numbers

E.g. - 0.0, 25.68



Boolean

True or False

Char - Any character of the key board

E.g. - 'k', '#', '7'

String - Any sequence of characters

E.g. - 'ICT', 'programming', 'Sri Lanka'

Important



Values of Char and String are included inside single quotation ' '.

1.4.4 Variables and constants

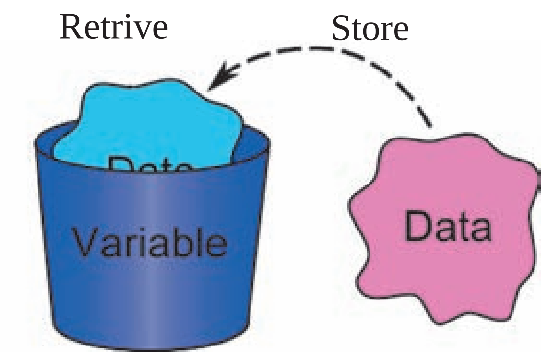
Variable

A variable is an identifier which changes the values given to it when the program is being executed.

In Pascal, “var” is used to declare variables.

E.g. -

```
var  count : integer;
var  a,b : real;
var      n1, n2 : integer;
         Avg : real ;
         Pass : boolean;
         Character : char;
         Name,school : String;
```



Important



A variable has a name, and it stores a value of the declared type.

Constants

The identifiers which do not change their values while the program is executed are called constants. In Pascal, “const” is used to declare a constant.

Example

```
Const        max = 100;
Const        pi = 22/7;
```

Observation



- When executing a program, a variable can take different values. However, the value of a constant remains unchanged.

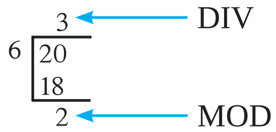
1.4.5 Operators

Operators are required to perform calculations, comparisons, and to evaluate logical expressions. Hence, operators are essential in programming.

Basic types of operators

1. Algebra operators

Operator	Usage	Example expression	Result
+	Addition	6 + 3	9
-	Subtraction	7 - 5	2
*	Multiplication	2 * 5	10
/	Division	10/4	2.50
DIV	Division of round numbers	20 DIV 6	3
MOD	Remainder after division	20 MOD 6	2



2. Comparison operator

Comparison operators are used to compare values or expressions. The final result of an expression which consists of a comparison always takes a Boolean value. Hence expression will be True or False.

Function	Usage	Example expression	Result
>	Greater than	7 > 3	True
>=	Greater than or equal	8 >= 8	True
<	Less than	3 < 2	False
<=	Less than or equal	4 <= 6	True
=	Equal	3 = 1	False
< >	Not equal	2 < > 5	True

3. Logical operators

Logical operators are used to combine two or more expressions. For further study on this refer. basic logic gates that you learnt in Grade 10.

i) AND operator

AND operator takes the form "(First Expression) AND (Second Expression)". Depending on the first expression or second expression being True or False, the result becomes True or False. The following table shows the function of AND.

First Expression	Second Expression	(First Expression) AND (Second Expression)
False	False	False
False	True	False
True	False	False
True	True	True

Example

1. (Rain fall > 56) AND (Temperature < 30)
2. (Height > 60) AND (Age < 15)
3. Let us consider, (3 >= 2) AND(3 < > 3)
   3 >= 2 is True. 3 < > 3 is False. Hence, the result of the expression is False.

Important



- If at least one operator out of the two operators is false, the AND evaluates to false.
- When only both operators are true, the expression of AND evaluates to true.

ii) OR operator

OR operator takes the form "(First Expression) OR (Second Expression)". Depending on the first expression and second expression being True or False, the result of OR is True or False. The following table shows the function of the OR operator.

First expression	Second expression	(First expression) OR (Second expression)
False	False	False
False	True	True
True	False	True
True	True	True

Example

1. (Temperature > 30) OR (Rainfall < 55)
2. Let us consider, (3 >= 2) OR (3 < > 3)
   3 >= 2 is True. 3 < > 3 is false. Hence, the result of the expression is true.

Important



- When at least one operator out of the two operators is true, the OR operator evaluates to true.
- When only both operators are false, the expression of OR operator evaluates to false.

iii) NOT operator

A True expression is always evaluated as false with a NOT operator while a false expression is always evaluated as true.

Expression	NOT (Expression)
False	True
True	False

Example

1. NOT (Temperature > 30)
2. NOT(5 = 5) is indicated as false statement.
   Therefore 5 = 5 is a true expression. Hence, the statement NOT (5 = 5) is indicated as false

Operator precedence

When Pascal expressions are evaluated, the order of precedence is given below.

Priority order	Operator						high
1	NOT						↑
2	*	/	DIV	MOD	AND		
3	+	-	OR				
4	=	< >	<	<=	>	>=	less

Evaluating expressions

E.g. 1	E.g. 2	E.g. 3
5 + 14 MOD 4	3 + 7 DIV 2	16 / 4 * 2
5 + 2	3 + 3	4 * 2
7	6	8

E.g. 4	E.g. 5
NOT (8 MOD 2 > 5)	4 >= 4 AND NOT(7 > 9)
NOT (0 > 5)	True AND NOT(False)
NOT(False)	True AND True
true	true

Let us identify the basic components of a normal Pascal program.

```
program addNum (input,output);
var
        num1,num2,total : integer;
        avg: real;
Begin
        Write('Welcome Pascal Programming');
        {calculate total and  average of two numbers}
        Writeln('Enter First Number');
        Read(num1);
        Writeln('Enter Second Number');
        Read(num2);
        total: =num1 + num 2;
        avg := total/2;
        writeln('Total is ' , total);
        writeln('Average is ' , avg);
End.
```

- program addNum (input,output); → Name of the program (addNum)
- num1,num2,total : integer; avg: real; → Declaring the variables
- Begin → Beginning of the main program
- {calculate total and average of two numbers} → Indicating comments
- Read(num1); Read(num2); → Input
- Write / Writeln / writeln statements → Output
- total: =num1 + num 2; avg := total/2; → Expressions which indicate the process
- End. → Ending of the main program

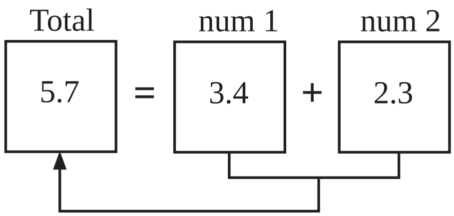
Note : To write comments (*..............*) can also be used.

- "program", "input" and "output" are reserved words.
- "addNum" is an identifier. This is the name of the program. It is not essential to indicate input, output within brackets with the program name.
- read( ) and readln( ) functions words are used for input.
    - ➢ Data is input to num1 variable through Read(num1);
    - ➢ Data is input from readln() from a new row.

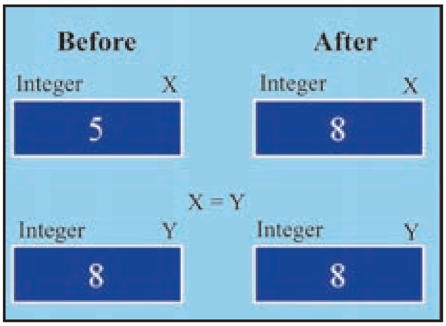
- write( ) and writeln( ) functions are used for output.
    - From the function Write('Welcome Pascal Programming') outputs 'Welcome Pascal Programming'.
    - The function writeln('Average is ' , avg); prints the value of the Avg variable in a new line.

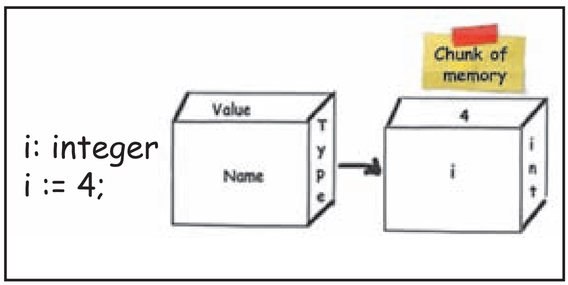
When writing Pascal statements;

- Semi-colon (;) is used at the end of an statement. Semi-colon indicates the end of an statement.
- What happens with the expression total := num1 + num2 is that it adds the variables num1 and num2 and assign result to the variable 'total'



- ":=" is the assignment operator.

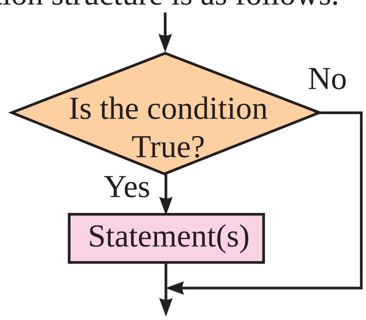




1.4.6 Selection

IF statement

If condition structure is as follows.



Flow chart

IF Condition THEN
Statement(s)
ENDIF

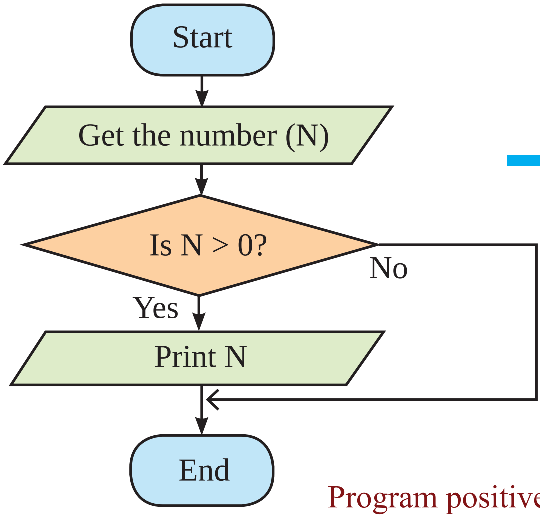
Pseudo Code

There are two types of IF statements.

i) IF... THEN.... ENDIF

Here, the statement will be executed if only the condition is satisfied.

E.g. 1 - If the input number is only positive, print the number.



Flow chart

```
Begin
  Input N
  IF  N > 0
THEN
        Print N
  ENDIF
End.
```

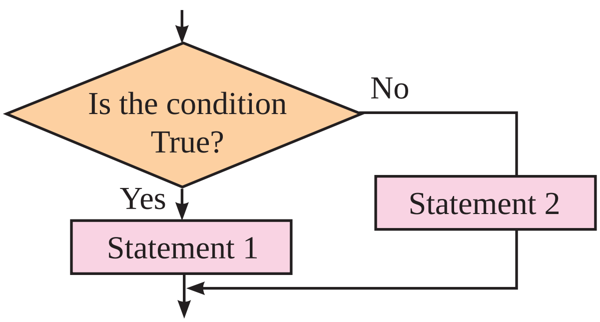
Pseudo Code

```
Program positiveNo(input, output);
Var  N : integer;
Begin
   Writeln('Enter Number');
   Read(N);
         If N > 0 then
   Writeln('Positive Number');
End.
```

Pascal Code

ii) IF... THEN.... ELSE .... ENDIF

If the condition is satisfied Statement 1 is executed if not Statement 2 is executed. The If condition structure is as follows.



Flow chart

```
IF  Condition  THEN
         Statement1
ELSE
         Statement2
ENDIF
```

Pseudo Code

E.g. 2 - Finding the larger number from two unequal numbers.

```
program LargeNo(input,output);
Var  N1,N2,Large: integer;
Begin
        Writeln('Enter Two Numbers');
        Read(N1,N2);
        If N1 > N2 then
                Large := N1
        Else
                Large := N2;
        Writeln('Large Number is ' , Large);
End.
```

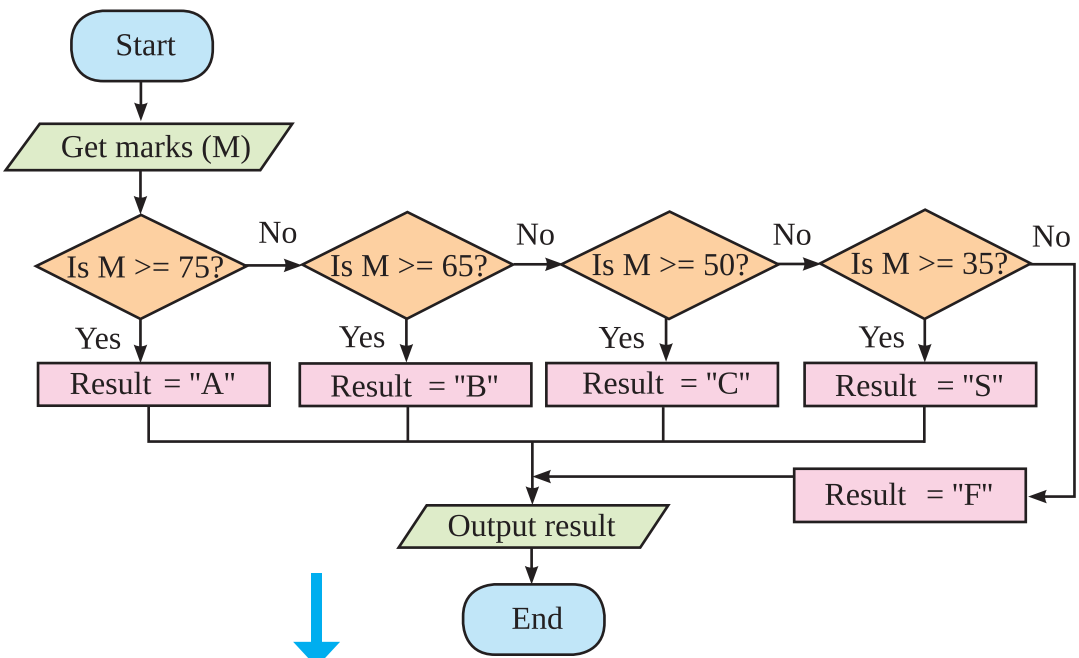
Pascal program

Nested IF

When there are multiple conditions one after the other, Nested IF is used.

i) Use of Nested IF when there are multiple conditions for a single variable

E.g. 3 - Finding the Grade when the marks scored by a student for a subject is given as input.



Flow chart

```
Begin
        Input Marks as M
        IF M >= 75 Then
            Grade = "A"
            ELSE
            IF M >= 65 then
                Grade = "B"
                ELSE
                IF M >= 50 then
                     Grade = "C"
                     ELSE
                     IF M >= 35 then
                         Grade = "S"
                         ELSE
                         Grade = "F"
                     ENDIF
                ENDIF
             ENDIF
        ENDIF
        Display Grade
End.
```

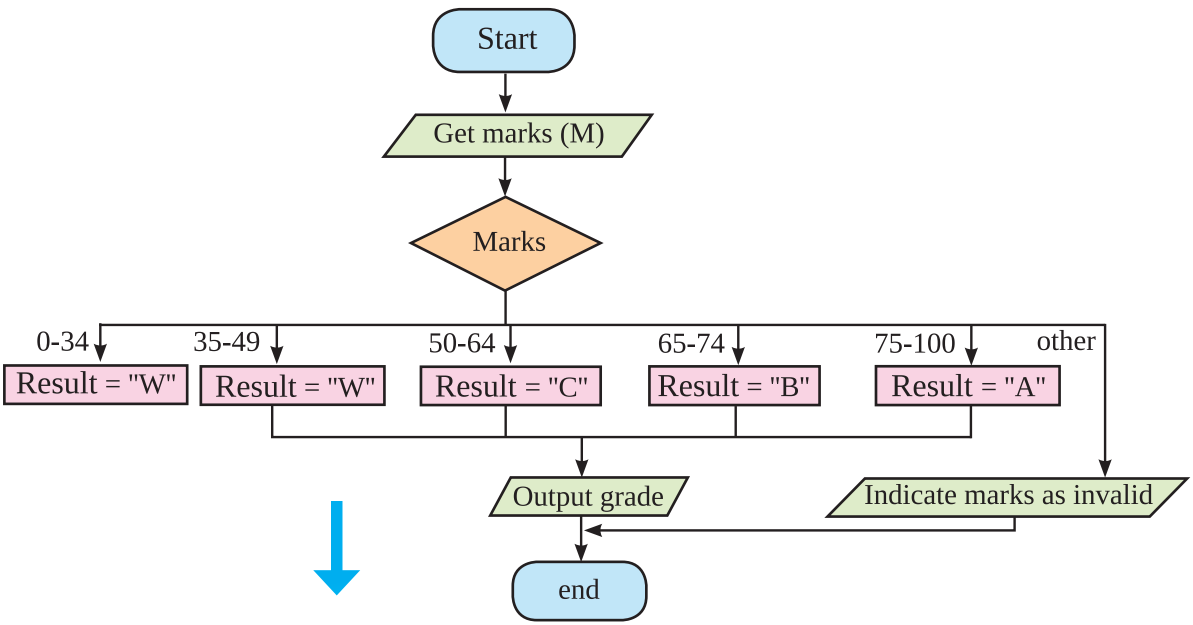
Pseudo Code

```
program GradeForMarks (input,output);
Var     M: integer;
        Grade: char;
Begin
        Writeln('Enter Marks');
        Read(M);
        If M >= 75 then
           Grade := 'A'
        Else
           If M >= 65 then
        Grade := 'B'
           Else
                       If M >= 50 then
                 Grade := 'C'
             Else
                 If M >= 35 then
                    Grade := 'S'
                 Else
                    Grade := 'F';
        Writeln("Grade = ", Grade);
End.
```

Pascal Code

Using CASE statement when a variable has multiple conditions

Rather than using IF…. THEN… ELSE… ENDIF if conditions repeatedly, it is easier to use CASE statement.



Flow chart

```
program FindGrade(input,output);
var     Marks : integer;
        Grade: char;
Begin
        Writeln('Enter Marks');
        Read(Marks);
        Case Marks of
                0..34 : Grade := 'W';
                35..49 : Grade := 'S';
                50..64 : Grade := 'C';
                65..74 : Grade := 'B';
                75..100 : Grade := 'A';
        Else
                Writeln('Invalid Marks');
        End;
        if (Marks >= 0) AND (Marks <= 100) then
                Writeln('Grade is ' , Grade);
End.
```

Pascal program

1.4.7 Repetition

Let us examine how repetition structures are used when the number of repetitions is known in advance.

i) FOR – DO structure (1st Method)

FOR Variable := Value_1 TO Value_2 DO

- The data type of Variable , Value_1 and Value_2 should be integer.
- The value of Value_2 should be larger than Value_1 to start repetition.
- Repetition is started with Value_1 and ended with Value_2.
- Hence, FOR – DO structure can be used when the number of repetitions is known in advance.

Repetition structure	Starting value	Ending value	Number of repetitions
FOR X :=1 TO 5 DO	1	5	5
FOR X := 0 TO 4 DO	0	4	5
FOR X := 5 TO 10 DO	5	10	6

E.g. - Printing the values from 1 to 10

```
Program print10Nos(input,output);
Var     count : integer;
Begin
        For  count := 1 to 10 do
        Writeln(count);
End.
```

Here the count variable value is changed from 1 to 10 while printing the output values, and two loop is executed 10 times.

ii) FOR – DO Loop (Method 2)

FOR Variable := Value_1 DOWNTO Value_2 DO

- The value of Value_1 should be smaller than Value_2 to start repetition.
- Repetition is started with Value_1 and ended with Value_2.

Repetition structure	Starting value	Ending value	Number of repetitions
FOR X := 10 DOWNTO 5 DO	10	5	6
FOR X := 4 DOWNTO 0 DO	4	0	5

E.g. - Printing of values from 10 to 1

```
Program print Reverse (input,output);
Var     count : integer;
Begin
        For  count := 10  downto 1 do
        Writeln(count);
End.
```

Count variable value is changed from 10 to 1 while printing the output and and the loop in executed 10 times.

Finding the total and average of ten numbers

```
program total_avg (input,output);
var     I,num,total : integer;
        avg: real;
Begin
        total := 0;
        for I := 1 to  10 do
        begin
                writeln('Enter Number');
                read(num);
                total := total+num;
        end;
                avg := total/I;
                writeln('Total is ' , total);
                writeln('Average is ',avg);
        end.
```

(The statements writeln('Enter Number'); read(num); total := total+num; are marked: A block of statments in repetition.)

Important



A block of statements indent properly is written between 'begin' and 'end'; inside the FOR loop.

When the number of repetitions are not known in advance, "While do" or "repeat until" structures are used.

i) WHILE DO Loop

- Conditions are checked at the beginning of the loop.
- Statements inside the loop are executed (ie: a loop that runs for ever) only if the condition is true.
- Statements inside the loop never executed if the condition is false.
- The condition becomes false at the end of the repetition.
- If the condition does not become false while the repetition is executed, it will be an infinite loop.

E.g. 1 - while number > 0 do
Repetition is executed if only the value of the variable number is positive.

E.g. 2 -
```
number := 1;
while number <= 10 do
        number := number + 1;
```

- Condition is true since the starting value of the variable 'number' is 1.
- Hence, the repetition is executed.
- Each time loop is executed, 1 is added to the value of "number".
- Hence, Loop is executed when the value of "number" is 10 or less than 10.
- Loop stops when the value of the "number" variable is 11.

ii) REPEAT UNTIL Structure

- Condition is not checked at the beginning of loop.
- Condition is checked, after the statements are executed once.
- Loop is started if the condition is false only.
- Loop stops when the condition becomes true.
- If the condition does not become true while the loop is executed, loop will be an infinite loop.

E.g. 1 -

```
count = 0;
Repeat
        writeln ('Pascal');
        count := count + 1
Until count > 5;
```

- The starting value of count variable is 0.
- The word Pascal is displayed on the screen.
- 1 is added to the count variable.
- It is checked whether the value of 'count' variable is larger than 5.
- Loop is executed till the value of the 'count' variable becomes 5.
- Loop stops when the value of count is 6.
- When the Loop stops, the word Pascal is displayed six times on the screen.

E.g. 2 -

```
sum := 0;
repeat
        sum := sum + 5;
        writeln(sum);
until sum < 50;
```

- The starting value of sum variable is 0.
- 5 is added to the value of sum.
- The value of sum is 5 and it is displayed on the screen.
- It is checked whether the value of sum variable is less than 50.
- The condition sum < 50 is satisfied (True).
- Hence, Loop stops.

E.g. 3 -

```
sum := 0;
repeat
        sum := sum + 5;
        writeln(sum);
until sum >= 50;
```

- The starting value of sum variable is 0.
- 5 is added to the value of sum.
- The value of sum is displayed on the screen.
- It is checked whether the value of sum variable is greater than or equal to 50.
- Loop is executed till sum >= 50 condition is satisfied (True).
- When the loop stops, the value of sum is 50.
- Loop is executed 10 times.
- Multiples of 5 from 5 to 50 will be given as output.

1.4.8 Nested control structures

Inside an algorithm, a control structure(s) may be included inside another. For example, a repetition loop may be included inside another repetition. Similarly a selection may be included inside another selection. Hence nested controlling structures should be used in programming.

1.4.8.1 Repetition inside selection

A repetition may be executed depending on a condition of a selection being satisfied or not.

E.g. - Depending on the user's selection, an ascending or descending number sequence can be produced as output.

```
program orderNos(input,output);
var     num:integer;
        cho:char;
begin
    writeln('Select Assending(A) or Desending(D)');
    read(cho);
    if cho = 'A' then
      begin
          writeln('Asending Order');
          for num := 1 to 6 do
             writeln(num);
      end;
    if cho = 'D' then
       begin
           writeln('Desending Order');
           for num := 6 downto 1 do
              writeln(num);
       end;
end.
```

1.4.8.2 Selection in repetition

Let us consider how selection takes place while the repetition control structure being executed.

E.g. - Determining whether the numbers input by the user are odd or even and calculating the total number of odd, even numbers separately.

```
program rep_sel(input,output);
var num,rem,count,e_count,o_count:integer;
begin
    for count := 1 to 10 do
       begin
           writeln('Enter Number');
           read(num);
           rem := num mod 2;
           if rem = 0 then
              begin
                  writeln('Even number ');
                       e_count := e_count+1;
```

```
            end
          else
             begin
                writeln('Odd number ');
                o_count := o_count + 1;
             end;
       end;
    writeln(e_count,'Even Number/s');
    writeln((o_count ,'Odd Number/s');
end.
```

1.9.1 Arrays

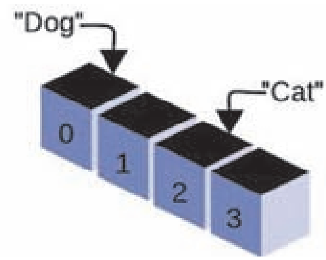
It is essential in programming to use variables to store data items in memory. Further, such variables have suitable data types. Various variables which are different in names are needed to store data items which belong to the same data type.

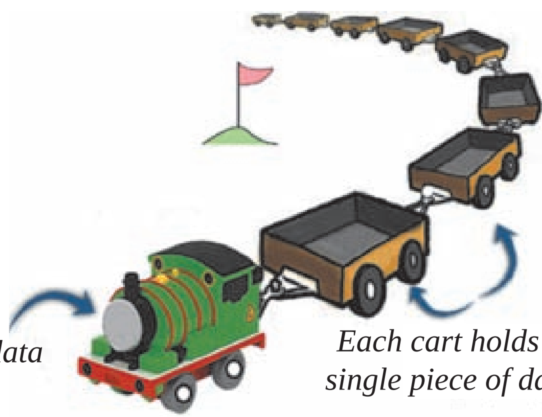
E.g. - For instance, five variables are needed to save five round numbers in the memory. Before using such variables, they should be declared as given below.

```
Var     p, q, r, s, t : integer;
        n1, n2, n3, n4, n5  : real;
```

1.4.9.1 Use of arrays

An array is used to save data items of the same type in memory using a single variable identifier name. Hence, use of array enables to store data as required under a single variable identifier name without providing different variable names to each item.





Here comes the data train

Each cart holds a single piece of data

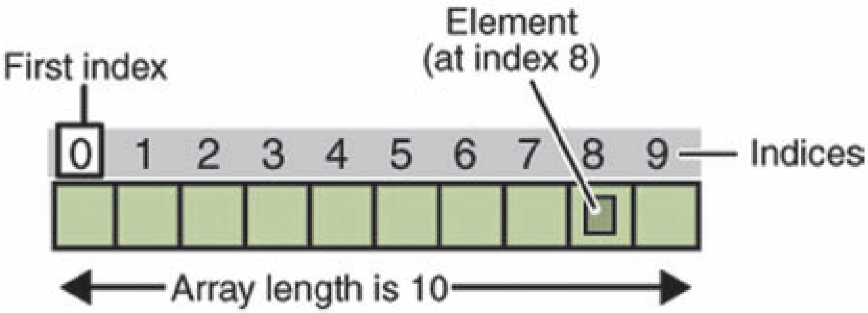
1.4.9.2 Defining a one-dimensional array

This is a data structure used to save data of the same type sequentially. An array uses a group of adjoining memory spaces. A one dimensional array can be as follows.

Var *Name_of_Array* : array [*first index* .. *last index*] of *data type*

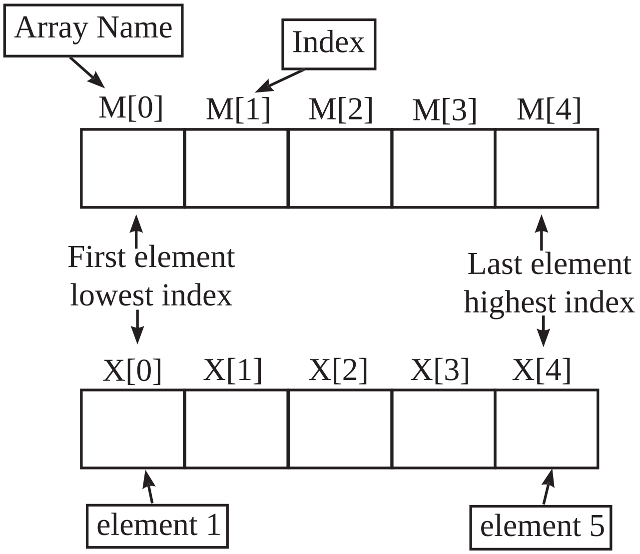
E.g. - var marks : array [0..9] of integer;

- From this, the array named marks is defined which can include 10 whole numbers.



1.4.9.3 Attributes of an array

- Elements of an array are positioned next to each other. (re adjacently)
- The index of an array (sequential number) is indicated with the array name in square brackets.



E.g. - the size of the array Var M : Array[0..4] of integer; is 5.

From M[0] to M[4], it consists of 5 elements.

Index is indicated in square brackets.

Depending on the way array is defined, index positions get changed.

E.g. - ; Var X : Array[1..5] of integer;

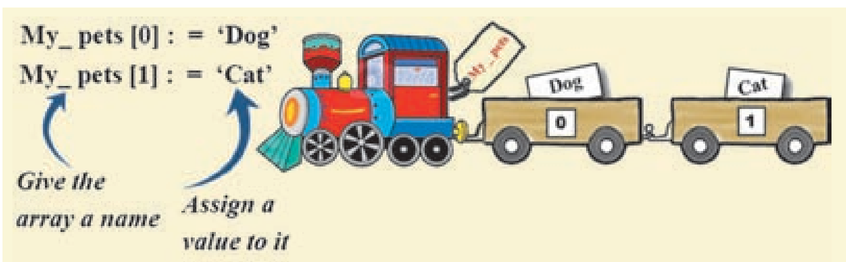
Only data items which belong to the same type can be stored in the array.

Any element of the array can be accessed randomly. Hence, an array can be accessed easily through a repetition control structure.

E.g. - Entering Maths marks of 40 students into an array

```
var     maths : array[0..39] of integer;
        i,marks : integer;
for i := 0 to 39 do
        begin
                writeln('Enter marks');
                read(marks);
                maths[i] := marks;
        end;
```

1.4.9.4 Assigning values to an array



Let us consider integer array with 5 five elements which can input whole numbers.

```
var     num : array[0..4] of integer;

        num[0] := 45;

        num[2] := 36,num[4] := 60;

        num[1] := num[4] + 15;
        num[3] := num[0] + num[2]
```

num[0]	num[1]	num[2]	num[3]	num[4]
45		36		60
45	75	36	81	60

1.4.9.5 Declaring values of an array

The elements declare the values of an array.

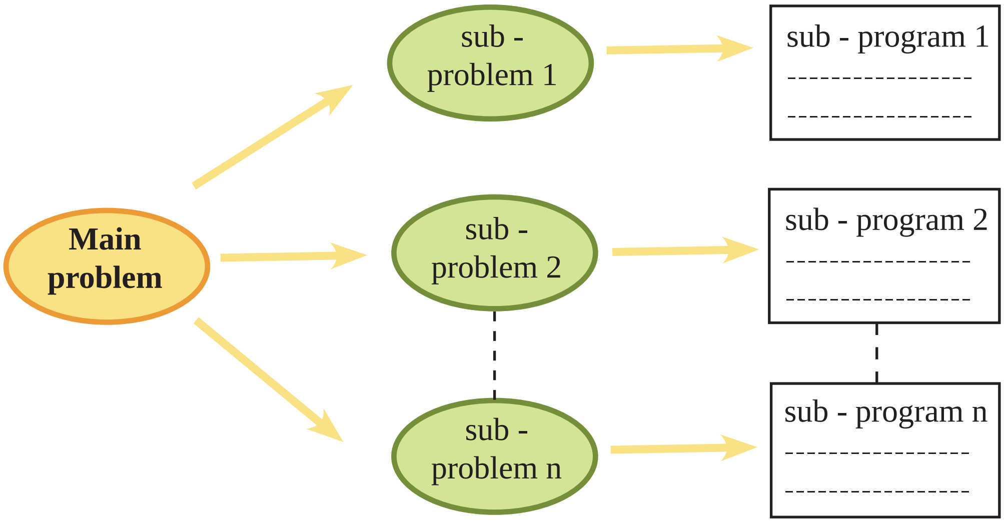
writeln (num[3]);	⟵	Print the 4th element (81)
writeln (num[1], num[4]);	⟵	Declaring 2nd and 5th elements (36, 60)
for x := 0 to 3 do	⟵	Print the first 4 elements of the array (45, 75, 36, 81)
writeln (num[x]);		
for x := 2 to 4 do	⟵	Print the 3 elements - 3rd, 4th, 5th - of the array (36, 81, 60)
writeln (num[x]);		
for x := 0 to 4 do	⟵	Print all the elements of the array (45, 75, 36, 81, 60)

E.g. - Entering Information and Communication Technology marks of 35 students, determining the highest mark and calculating the average.

```
program ictMarks(input,output);
var marks : array[0..34] of integer;
   i,tot,max : integer;
   avg : real;
begin
    for i := 0 to 34 do
       begin
           writeln('Enter Marks');
           read(marks[i]);(* Read Marks to array *)
           tot := tot + marks[i];(* Add marks *)
       end;
    avg := tot/35;
    max := marks[0];
    for i := 1 to 34 do
       if marks[i] > max then max := marks[i];
    writeln('Maximum marks = ', max);
    writeln('Average marks = ',avg);
end.
```

1.4.10 Use of sub - programs

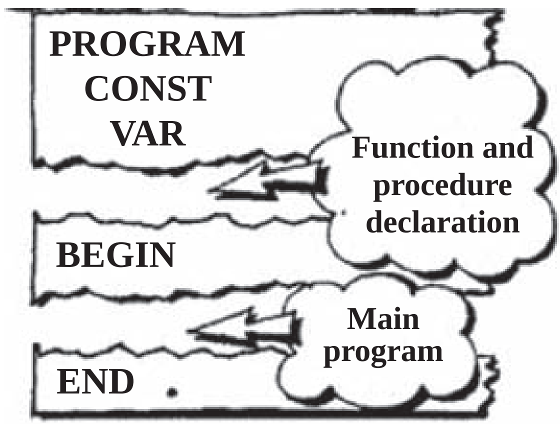
As a program becomes complex, when the number of sub processes increase, it will be difficult to read and understand and also to maintain. Therefore, using sub programs as much as possible while writing useful.



1.10.1 Types of sub - program

There are two types of sub - programs in addition to the main program. A sub - program which returns an output back to the main program and a sub - program which does not return an output back to the main program. A sub - program which returns an output back is called a **Function** and a sub - program which does not give an output is called a **Procedure.**

1.10.2 Introducing sub - programs



Before starting the main program, functions and procedures should be declared. Sub - programs can be called for in the main program. (Calling a function or a Procedure).

The following is the syntax to define a procedure.

Procedure Name_of_Procedure(name_of_variable : data type);

E.g. - Procedure to find the area of a circle

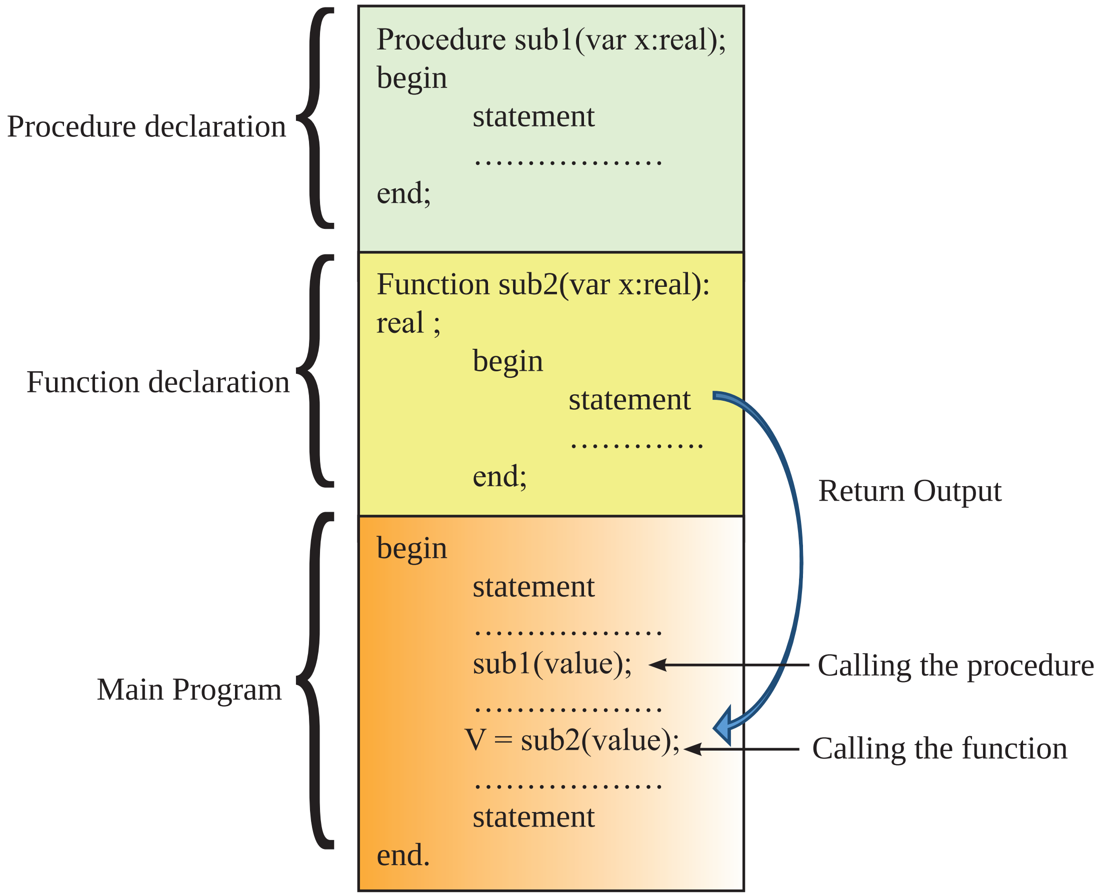
Procedure calculateArea(var radius:real);

Function Name_of_Function(name_of_variable : data type) : data type ;

E.g. - Function to find the area of a circle

Function calculateArea(var radius : real): real ;

The following syntax define a function.



E.g. - Let us consider the program to calculate the area and circumference of a circle.

1. A program built with procedures

```
program procedure_circle(input,output);
const pie = 22/7;
var radius:real;

procedure getData(var radius: real);
        begin
            writeln('Enter Radius');
            read(radius);
        end;
procedure processArea(var radius:real);
        var area:real;
        begin
            area := pie * radius * radius;
            writeln('Area = ',area);
        end;
procedure processCircumferance(var radius:real);
        var circum:real;
        begin
           circum := 2 * pie * radius;
           writeln('Circumferance = ',circum);
        end;
begin
    getData(radius);
    processCircumferance(radius);
    processArea(radius);
end.
```

2. A program with functions

```
program function_circle(input,output);
const pi = 22/7;
var radius:real;

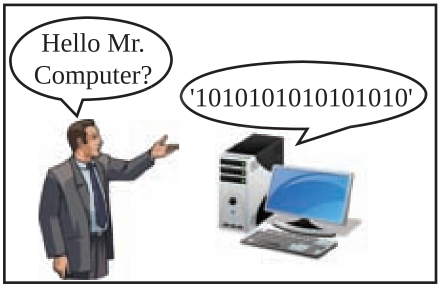
function processArea(var radius:real):real;
        var area:real;
        begin
            area := pi * radius * radius;
```

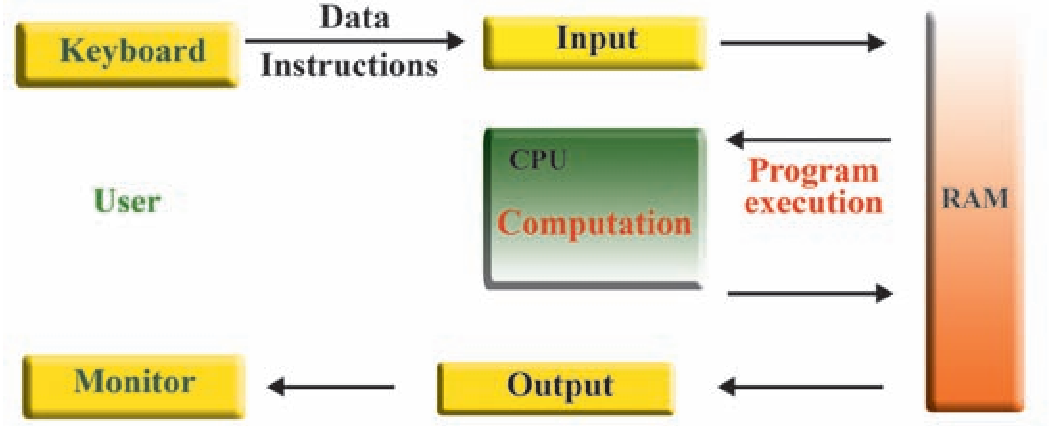
```
            processArea := area;
        end;
function processCircumference(var radius:real):real;
        var circum:real;
        begin
           circum := 2 * pi * radius;
           processCircumference := circum;
        end;
begin
    writeln('Enter Radius');
            read(radius);
    writeln('Circumference = ',processCircumference(radius));
    writeln('Area = ', processArea(radius));
end.
```

1.5 Evolution of programming languages

1.5.1 Need of a programming language

A program is a sequence of instructions which is designed to perform a certain task is using the computer. A computer language is needed to provide the instructions.





1.5.2 Low level programming languages

Machine language

This is a language which can be directly understood by the computer. Binary numbers such as 0s and 1s (bits) are used to provide instructions. Hence, the processor could directly run a program written in a machine language.

A program written in machine language has the following features;

- Could be executed directly on the machine
- Fast in operation
- No need of language translating programs to translate the program into binary
- Dependency on machines (a program written to one computer may not run on another computer)
- Difficult to understand by humans as it is written using 0 and 1.

Assembly language

Instead of commands written in a machine language using 0 and 1, assembly language is designed to use simple symbols.

A program written in assembly language has the following features:

- Operation is comparatively slower than the machine language.
- Assembly language should be translated to instructions using the language translating program called assembler.
- Dependency on machines (a program written for one computer cannot be run on another computer.)
- The use of symbols makes it more simple to understand.

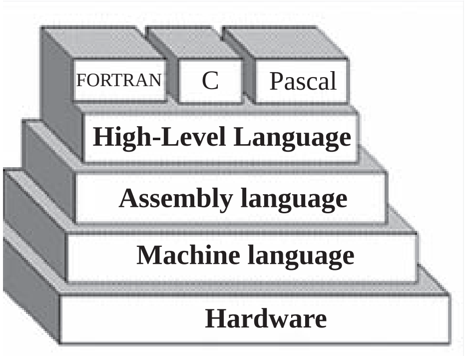


1.5.3 High-level programming languages

Languages which are designed with simple English words enabling the programmer to understand it easily are called high-level computer languages.

Examples for high level computer languages

FORTRAN, BASIC, COBOL, PASCAL, C



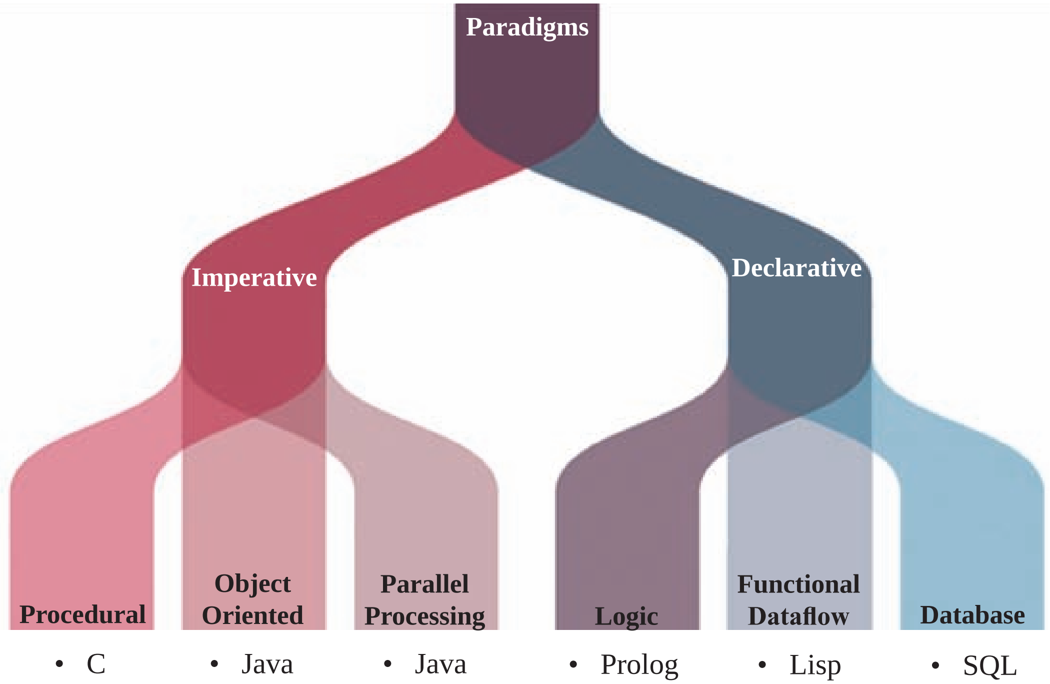
A program written in a high-level language has the following features:

- Easy to understand.
- Need to be translated to machine language instructions before executing on a computer.
- Does not depend on the machine.

1.5.4 Programming language types

Programming is a creative task where a computer programmer provides instructions to the computer on how to perform a particular task. A program can be defined as a set of instructions which instructs the computer which task should be carried out to find a solution to a certain problem.

There are many different approaches to computer programming. These are called programming paradigms. Different approaches develop solutions to problems using programs using different paradigms. Even though most of the programming languages come under one paradigm type, certain languages show elements related to different paradigms.



Programming Paradigms

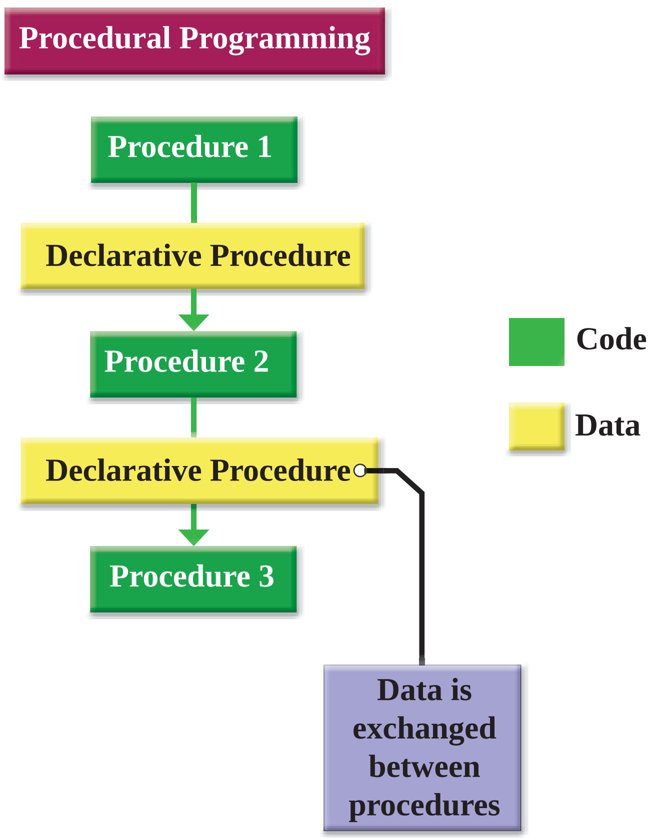
Imperative/ Algorithmic	Declarative		Object-Oriented
	Functional Programming	Logic Programming	
Algol Cobol PL/1 Ada C Modula - 3	Lisp Haskell ML Miranda APL	Prolog	Smalltalk Simula C++ Java

There are a number of programming languages. There are differences among different programming language types.

Difference between procedural and declarative paradigms

A procedural language is a computer programming language which consists of a well structured set of steps and procedures. This includes statements for problem solving steps.

Example -



The Pascal programming has procedural paradigm features.

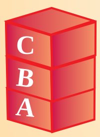
A declarative paradigm develops a structure and elements of computer program by indicating calculations and/or logic without a control flow. This helps to reduce or eliminate side effects. In declarative programming, program is designed to solve problems explaining what you want rather than stating how to solve the problem as in primary programming languages. The program itself does not explain how it is executed. This means the computer is provided only what the problem and the required solutions are, not how to solve it. The computer finds solutions related to the given problem. This is completely different from procedural paradigms which execute algorithm as explanatory steps. Declarative paradigms related to Artificial Intelligence.

Important



Procedural Paradigm

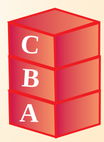
Saying how you achieve it



1. Keep block A
2. Keep block B on top of block A
3. Keep block C on top of block B

Declarative Paradigm

Saying what you want



A pillar which consists of 3 blocks

Comparison of structured and object oriented paradigms

A structured program is a logic based paradigm and it is the pre discussed object oriented program. A structured programming paradigm provides facilities to understand and modify the program. The system is divided into sub systems and there is a top – down flow in it.

Structured Program

Informs the user to enter data

↓

Retrieves data entered by the user

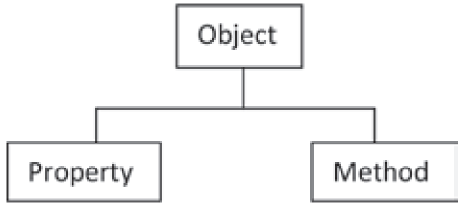
↓

Data is processed

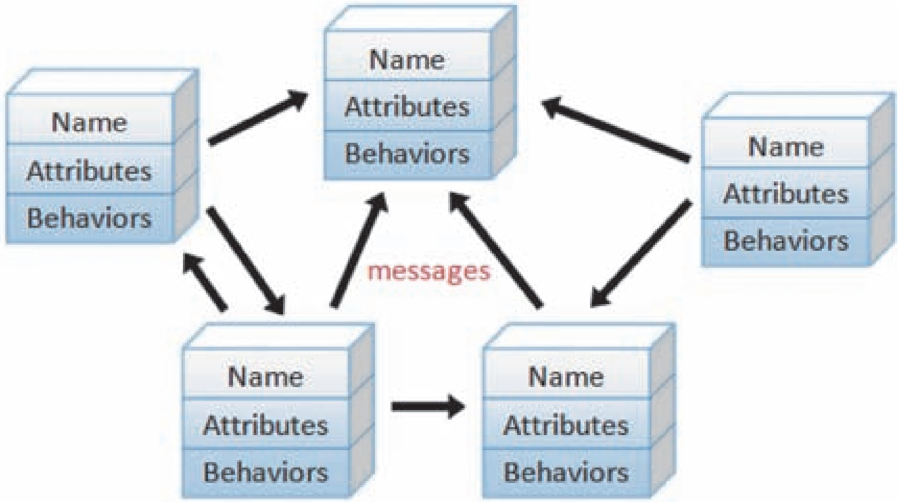
↓

User is given the output

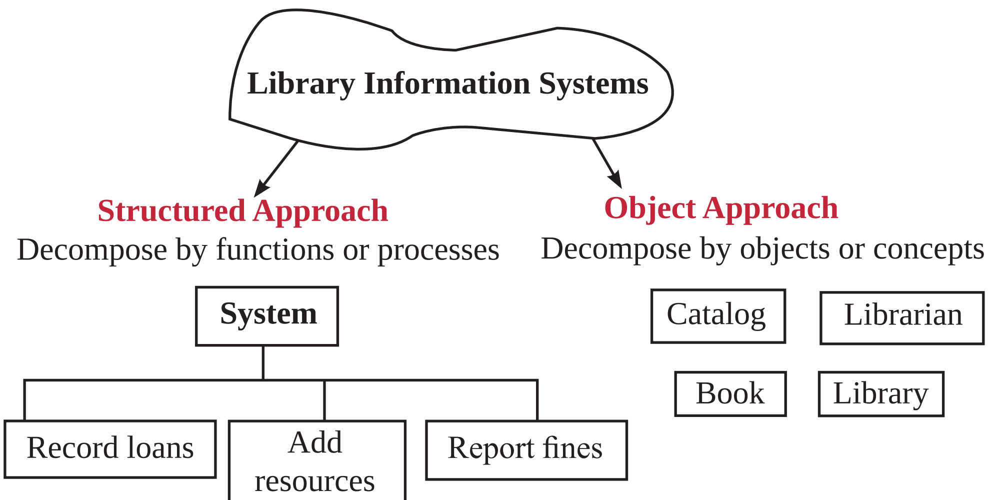
The Pascal programming has the structure of structured programming as well.

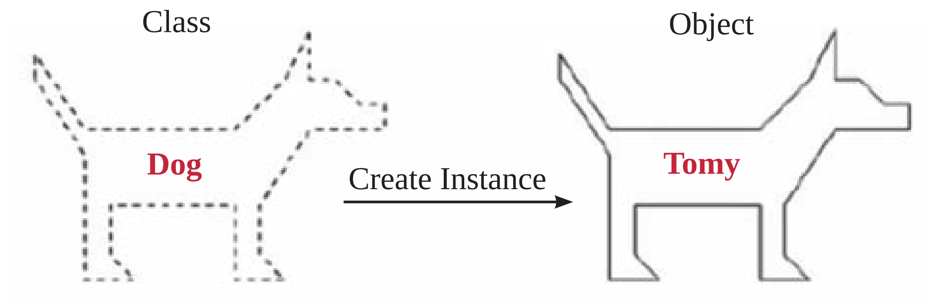


Object oriented programming is a programming paradigm based on the concept of **objects**. Objects consists of data and methods. Methods are codes that are in the form of procedures that handle data. These data structures exist in the form of fields which are called **Attributes**. Class is the basic structure of object oriented programming. Class describes the behaviours of data and instances. **Class** can create objects of same type.

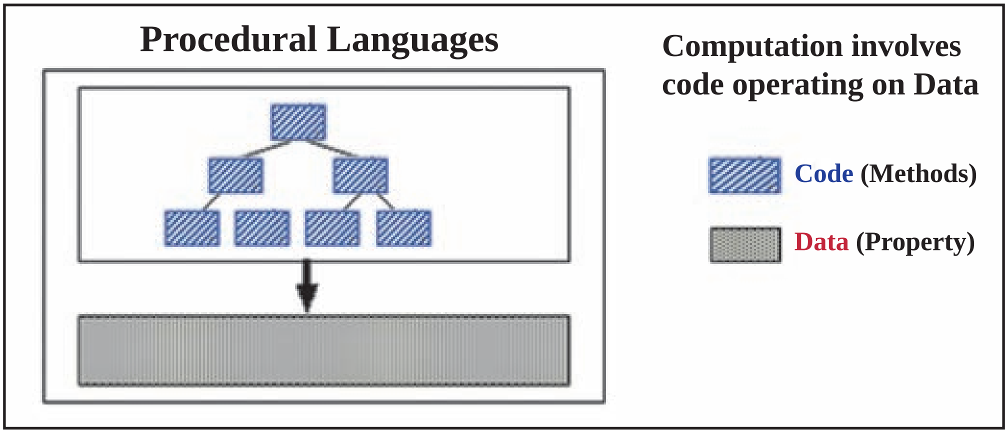


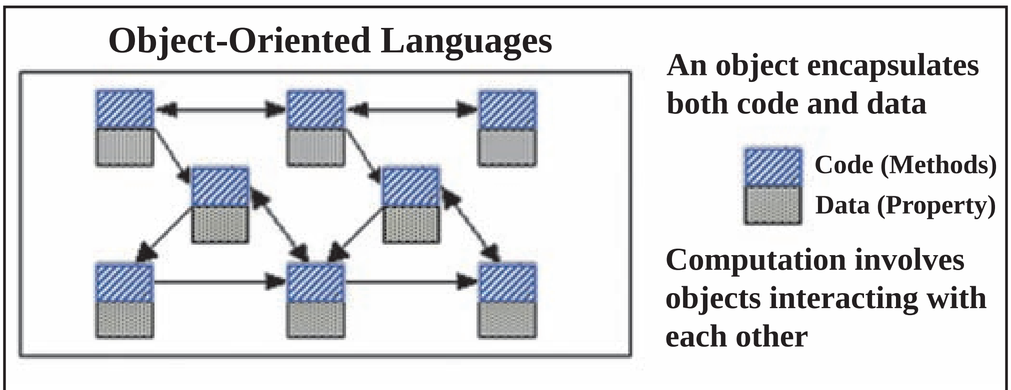
An object-oriented program consists of many objects interacting with each other by sending messages





Property (Data)	Methods (Code)	Property Values	Methods
Color	Sitting	Color - Gray, White and Black	Sitting
Eye Color	Laying	Eye Color - Blue and Brown	Lying
Height	Shaking	Height - 18 Inches	Shaking
Length	walking	Length - 36 Inches	Walking
Weight		Weight - 30 Pounds	





Activity

Consider Car as a class and identify its properties and methods and a few objects in that class..

Programming and scripting

Usually, there are hard and fast syntax rules in programming languages. These should often be compiled. Programming languages need to be compiled. Further, scripting languages should be interpreted.

Both JavaScript and PHP are scripting languages.

Activity

Compare the differences between the programming paradigms given below.

- Procedural vs Declarative
- Structured vs Object oriented
- Programming vs Scripting

1.5.4 Language translators

Programs written in any computer language except in machine language (object code) should be translated to machine language instructions before execution.

A program written in assembly language is translated to machine language instructions using a language translator called **assembler.**

Two types of language translators can be used to translate a program written in a high-level language to machine language instructions. They are:

1. Interpreter
2. Compiler

Interpreter

This is the language translator which translates each statement written in a high-level computer language to machine language commands one by one and the translated program is executed using the necessary commands instantly.

When translating object codes in computer languages which use interpreters,

1. If there are no syntax errors in the program, the statement will be executed
2. If there are syntax errors in the program, it will not execute to the end. (it is possible to operate it till the error is reached)

Important



An interpreter translates code each time the program is executed.

A program written in high level language → Interpreter → Machine language instructions

Compiler

Compiler translates the entire program written in a high level language to machine language as a whole, before it could be executed.

A program written in high level language → Compiler → Machine language instructions

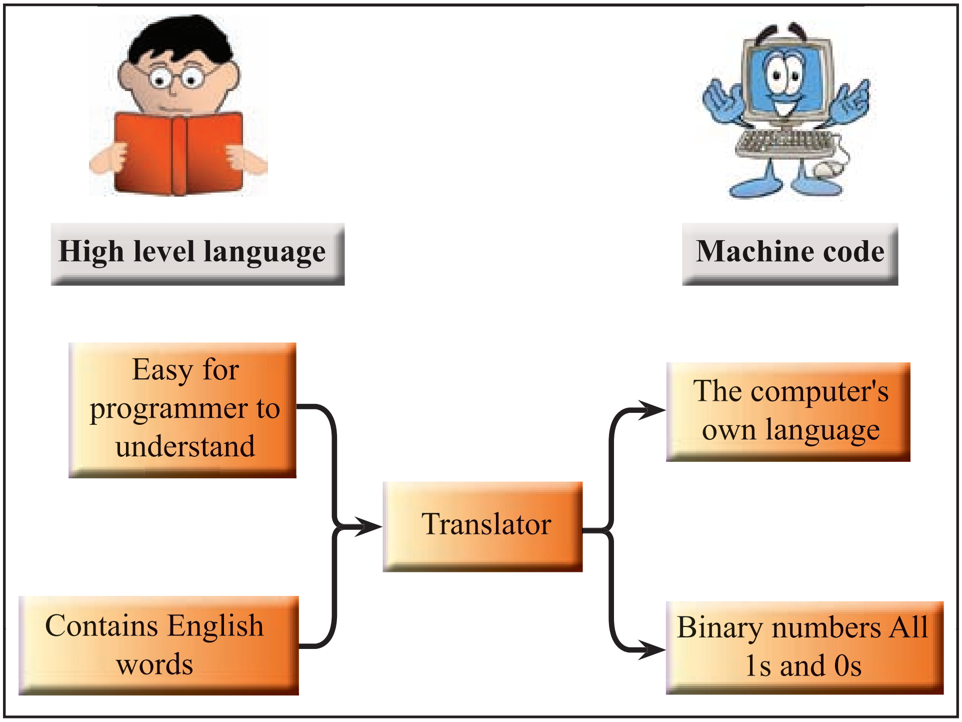
When translating source code to machine code in computer languages which use compilers:

1. If there are no syntax errors in the program, code is translated to machine code.
2. If there are syntax errors in the program, it is not be translated to machine code. These errors are highlighted.

Important



After the program is translated to machine code once, it can be execute any number of times. A translation is needed again only if the source code is changed.



Summary

- Input, output and the process can be identified by analyzing a problem.
- Flowcharts and pseudo codes can be used to develop an algorithm.
- Sequence, selection and repetition are three control structures used in an algorithm.
- Sequence performs steps in an algorithm one after the other from the beginning to the end.
- Selection is a situation where the step executed should be decided based on a condition being fulfilled or not.
- If a step or some steps in an algorithm are repeated until a condition is satisfied or to maintain the condition being satisfied, it is called repetition.
- A name used to identify a variable, constant or a program is called an identifier.
- If the values assigned for identifiers are changed when the program is being executed, these are called variables.
- Pascal is a high level programming language.

- Evaluation of an expression occurs depending on the priority level of functions.
- Machine language and Assembly language are considered low–level programming languages.
- Languages like PASCAL, BASIC, C and JAVA are examples of high–level programming languages.
- A program written using Machine language can be directly run in the processor.
- A program written in any computer language except in Machine language should be translated to Machine language instructions before it runs.
- Interpreter and Compiler are two translation programs.

2 System Development Life Cycle

After studying this chapter, you will understand the following:

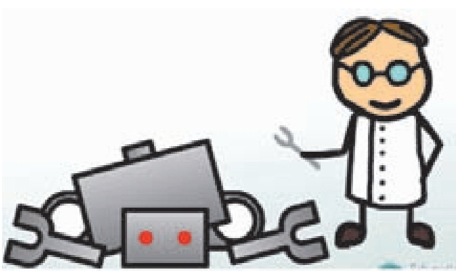
- What is a system?
- Interactions among components in a system
- Manual information systems vs computer based information systems
- The ability to determine why a system is necessary
- Steps in the development process of an information system
- The use of life cycle models to develop information systems

2.1 The Concept of Information Systems

What is a system?

A system is a collection of components that interact to achieve a specific task.

According to figure 2.1 below, the elements that form the road construction machine are not interconnected. Therefore, the machine does not function properly and road construction is not possible. Figure 2.2 highlights an interconnected road construction machine. It is possible to use this machine for construction work in order to achieve the goals. Figure 2.2 shows a machine working as a system.



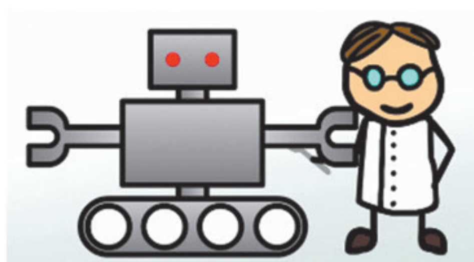


Figure 2.1 The road construction machine Figure 2.2

Basic Elements of a System

A system consists of three basic components.

1. Input
2. process
3. output

Input received by a system is converted to output by processing.



Figure 2.3 - Basic components of a system

Example 1 - Consider the school as a system.

System	-	School
Objective	-	To produce a responsible, worthwhile, just citizens to society
Input	-	Children
Process	-	The child is subjected to the teaching/learning process through interactions of teachers and other resources
Output	-	Providing good citizens to the country

Example 2

Output tomorrow's weather by a weather forecasting system taking atmospheric pressure, temperature, wind direction, humidity as input.

Information Systems

A system which converts data into Information is known as information system.



Figure 2.4

Information systems can be classified as: Manual Information Systems and Computer Based Information Systems.

Manual System

In this type of a system all processes are done manually.

Example - Let us consider a manual student information system

A child admitted to a school receives a registered number. A file is prepared which contains personal information about the child. This file also contains information about special abilities displayed while in school and achievements recorded.

Assume that the principal requires a progress report on the student of the previous year. The input, process and output here are as follows;

Input

Name of student and relevant year

Process

1. Find the index number of the student
2. Find the personal file according to the index number
3. Extract the required information for the relevant year from the file
4. Prepare a report using this information

Output

Progress report on the student for the relevant year

Activity

Assume that the above school has a computer based information system instead of the manual system. Compare and contrast the advantages and disadvantages when the above information is obtained from the manual system and the computer based information system.

Computer Based Information Systems

A system which converts data into Information using a computer is known as a computer based information system.

Consider a computer based library information system. Some of the benefits to a librarian in using a computer based library system are as follows.

- Ability to detect whether a particular book is available in the library and if available, the location of the book.
- Ability to use a bar code to maintain issues and receipts
- Ability to automatically calculate fines for late returns
- Ability to search for books efficiently

- Ability to maintain records of those who have borrowed books
- Possibility to list those who have failed to return books on due dates
- Establishes an online system for remote reservation and searching for books
- Ability to provide e-books to members
- A computer based library system can be networked with the main office of the school providing facility to confirm the return of library books by the students when issuing leaving certificates.

Activity

List benefits of a computer based library information system.

Main differences between manual systems and computer based information systems

Computer based information systems	Manual systems
Errors are minimal with data processed by a computer program	Since the data is manually processed, there is more room for error.
Data can be processed more efficiently	Processing of data is less efficient
Large amounts of data can be stored in a small physical surface. Database software can be used for the purpose.	Requires a large space for data storage. Filing cabinets are required to store files
Security can be ensured with backups and the use of passwords	Data is open to a lot of threats. Is not as safe as a computer based system.

2.2 System Development Processes

To develop an information system, there are different methodologies. The System Development Life Cycle is one aspect of the process.

2.2.1 System Development Life Cycle

This has the following steps.

1. Identification of requirements
2. Designing the solution
3. Coding of the solution
4. Testing and debugging
5. Deployment of the system
6. Maintenance of the system

This process can be iterated to go back to the first step when new requirements arise.

Phases of System Development Life Cycle



1. Identification of requirements

A complete investigation on the existing manual system or the computer based system to be delivered is carried out in this phase. Aspects such as objectives, benefits, efficiency etc are constructed. This is carried out in collaboration with the staff of the organization and the development team.

At this stage the system analyst will study the existing system extensively and identify new requirements. The developer also collects information to fulfill the needs of the user.

There are several methods of gathering information. Some of them are as follows;

1. Observation
2. Interviews
3. Questionnaires
4. Document sample collection
5. Prototyping

1. Observation

At the initial stages of developing a computer based system, the existing system is observed as it is, to gather information. This is important towards making assumptions.

E.g. - Observation of issuing of books in a library

2. Interviews

Since the interview provides an opportunity to discuss matters related to personal attitudes openly, it is useful to identify personal requirements.

E.g. - Meeting the librarian for a discussion.

3. Questionnaires

A questionnaire is used in user requirement gathering. Answers collected are analyzed for understanding the needs.

E.g. - Handing over a questionnaire to the librarian for his/her responses

4. Document sample collection

Reports or files maintained in an organization under study are examined for information.

E.g. - Reports, library cards available in a library

5. Prototyping

A model or a prototype of the proposed system to be implemented is developed and demonstrated to the staff and the users for feedback and comments.

E.g. - A display of screenshots, records, samples

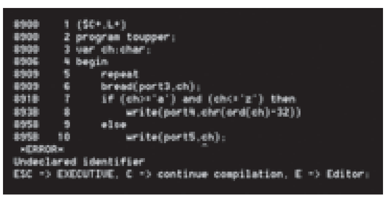
2. Designing the solution



At this stage, actual design of the proposed system takes place. Some activities related to the design process are as follows:

1. Identification of software and software architecture
2. User interface - what the user sees on the screen and preparation for data storage
3. Identification of main hardware systems and its components
4. Identification of dependency of each sub-system
5. Deciding on the required hardware and software to run the system
6. Designing infrastructure for software, databases, user interfaces
7. Planning of tests

3. Coding of the solution



The main objective of this stage is coding of the proposed system, using a suitable computer language. Making the code simple and efficient enables one to develop and understand easily. A well-written code makes it easy to read and understand and reduces maintenance cost.

4. Testing and debugging



The main objective of this phase is to resolve errors. Errors in cording, planning and requirements are corrected.

There are several methods to test a system. Some of them are as follows:

Unit testing

↓

Integration testing

↓

System testing

↓

Acceptance testing

Figure 2.5 - System Testing

1) Unit Testing



Each unit in the system is tested. Outputs are tested against the given output.

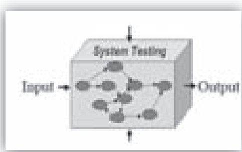
E.g. - Testing the units related to the Accounts branch and Establishment branch independently.

2) Integration Testing



Units already tested and debugged are integrated to form the complete system and the integrated system is tested at this stage.

3) System Testing



The complete system is tested for its outputs for the given inputs.

4) Acceptance Testing



Acceptance or user acceptance testing is carried out at the late stages of testing. This testing is carried out at with the users of the system and the user is allowed to use the system. Either the user approves or request for more improvements.



5. Deployment of the system



Deployment (ie install and use) of the system which has been tested and debugged is carried out at this stage.

There are different deployment approaches to deploy a system. They are as follows:

1. Direct deployment
2. Parallel deployment
3. Pilot deployment
4. Phased deployment

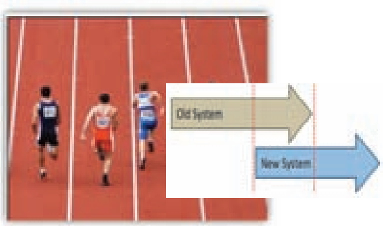
Direct deployment



The existing system is totally terminated and the new system is installed. If the new system proves successful, the old system can be abandoned.

E.g. - The manual system in the library can be totally abandoned using and new library management software can be installed.

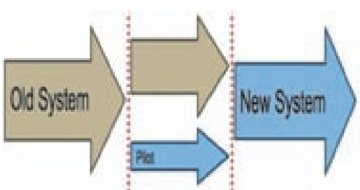
Parallel deployment



The existing and the new systems are used parallel for a certain period. If the new system proves successful, the old system can be terminated and the new system continues.

E.g. - Using the newly deployed system in the library together with the existing manual system.

Pilot deployment



Pilot deployment is about using the newly developed system in a selected area.

E.g. - A system for the whole country can first be installed in a selected district.

E.g. - A system for revenue collection from vehicles can first be installed in one province of the country and if, successful, can be deployed in all provinces of the country.

Phased deployment



Here, the new system is deployed in stages. Success with each stage leads to the next and in completing the new system, the old system is completely replaced by the new.

E.g. - Types of books in school library, i.e. Dictionaries first, course books second and fiction last, to be deployed in stages.



6. Maintenance of the system



A system once installed and in the use for a certain period, needs to be maintained well. The computers, software and computer networks are all maintained in this manner.

With system maintenance, the following may be required.

- Developing systems to suit new user requirements
- Issues that surfaced with the use of the system which were not identified during system development.
- Adopting new, technology into the new system to improve efficiency

2.2.2 System Development Life cycle Models

There are several models of Systems Development Life Cycle. Each model facilitates the system development in different ways. Some example models are:

1. Waterfall Model
2. Iterative Incremental Model
3. Prototyping Model
4. Spiral Model

Waterfall Model

The Waterfall Model consists of several stages of linear development. To develop a system using the Waterfall Model, the following need consideration.

- First identify requirements
- Complete one stage before going to the next phase
- The result of the developed system is found at the final stage. This model has a limitation of developing a system that is different to what the user wants as the user sees the system at the end of the Life Cycle.

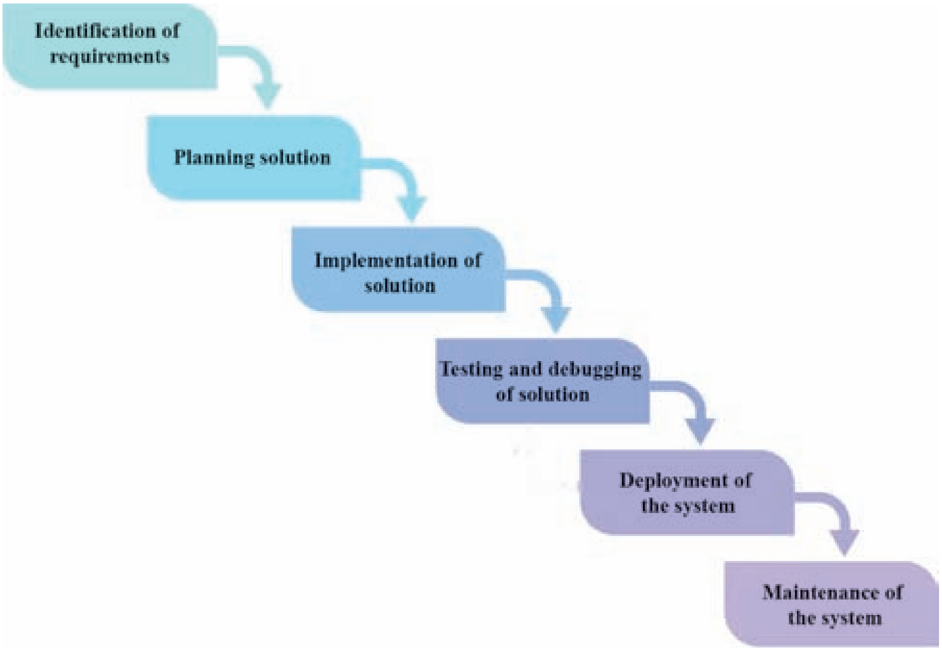


Figure 2.6 - Phased System development model - Waterfall model

Iterative Incremental Model

Iterative Incremental Model is also used as a system development model.

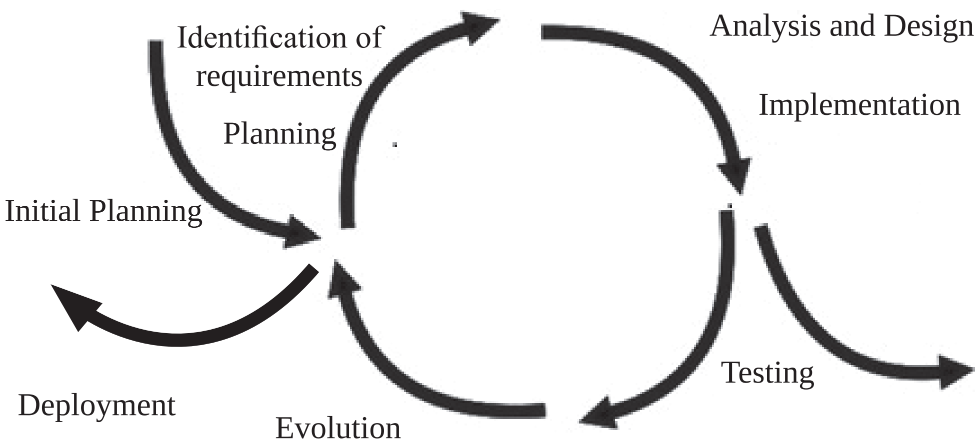


Figure 2.7 - Iterative Incremental Model

In this model, a system is developed through repeated cycles (Iterative) and in smaller portions at a time (incremental). The process starts with a simple implementation of a sub-set of the software requirements and iteratively enhances the evolving versions until the complete system is implemented. At each iteration, design modifications are made and now functional capabilities are added. This modal allows software developers to take advantage of what was learned during development and use of the system.

Activity

Compare and contrast the Waterfall model with iterative incremental model.

Summary

- A system is the collection of different components that usually interconnected towards a common objective.
- Any system consists of three basic components namely input, process and output.
- Information systems transform data into information.
- Information systems can be divided into Manual Information Systems and Computer based Information Systems.
- Manual Information Systems does not use computers and performs tasks using human.
- Computer based Information Systems use a computer to transform data into information.
- A system can be developed or an existing system can be made more efficient by using the system development life cycle.
- The system development life cycle consists of the following:
    1. Identification of Requirements
    2. Designing Solution
    3. Coding of Solution
    4. Testing and Debugging
    5. Deployment of System
    6. Maintenance of System
- The waterfall life cycle model and iterative incremental models are examples for system development life cycles.

3 The Internet and the electronic mail

After studying this chapter, you will be able to understand the following:

- Internet operation
- Internet services
- Searching information
- Uniform Resource Locator-URL
- IP addresses
- Domain name
- Domain name server
- Protocol
- Electronic mail
- Video conference
- Social networks

3.1.1 Introduction of the Internet



The Internet is a collection of computer networks around the world. It is the fastest available way to share information with the world community (Information super highway). With the use of Internet today, the whole world has become a global village. The Internet, which renders such a big service, does not possess a single owner and a non profitable organization called "The Internet Society" is in charge of the ethics and principles related to the use of the Internet and the protocols which maintain Internet operations. When you access the Internet from your computer, it also becomes a computer which belongs to the Internet. Then it is possible for you to obtain any information related to any subject you need.

3.1.2 Let us examine what URL is

Information which helps us to improve our knowledge is a very important resource. Among the avenues of obtaining information, the Internet is the most powerful. To transmit this information among the computers in the Internet, the protocol called HTTP (Hypertext Transfer Protocol) is used. Further, the Internet contains a huge amount of information. The main service which provides this information is the World Wide Web (www). Therefore, the information in the World Wide Web is included in web sites. Thus, the system used to uniquely identify various resources in web sites is the Uniform Resource Locator (URL).

Let us identify parts of a URL

For example, let us consider the URL given below.

http://www.edupub.gov.lk/e-books/english/ict.pdf

We can separate the parts here as given below.

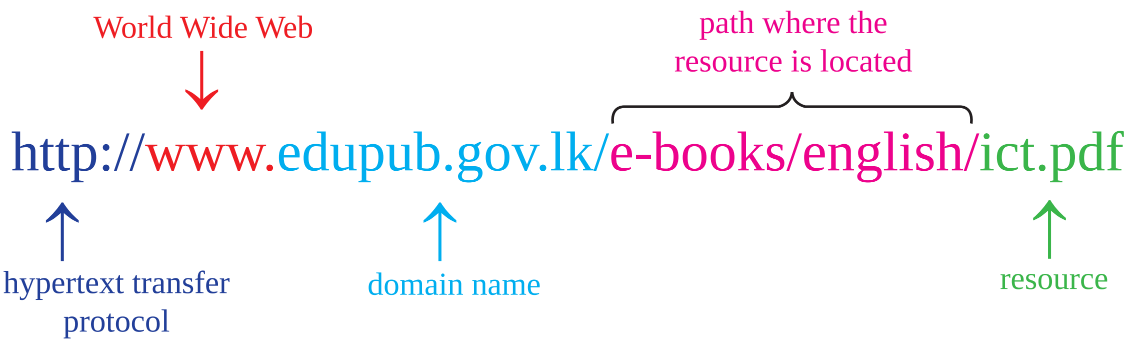


Figure 3.1 - Uniform Resource Locator

Note: In a Uniform Resource Locator, it is a must to have, from HTTP protocol to Domain name.

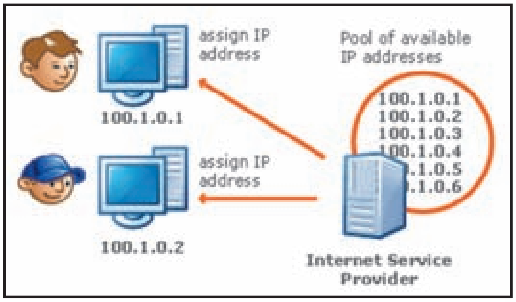
Given below are some URL related to the field of Education.

http://www.moe.gov.lk	- Ministry of Education
http://www.nie.lk	- National Institute of Education
http://www.doenets.lk	- Department of Examinations
http://www.edupub.gov.lk	- Educational Publications Department

3.1.3 what is an IP address?

Internet Protocol (IP) addresses are used to individually identify all the computers in the Internet. The IP address is indicated in four values from 0 to 255 separated by a decimal point. This is called Dotted Decimal Notation.

Example 172.64.85.42
193.213.78.154



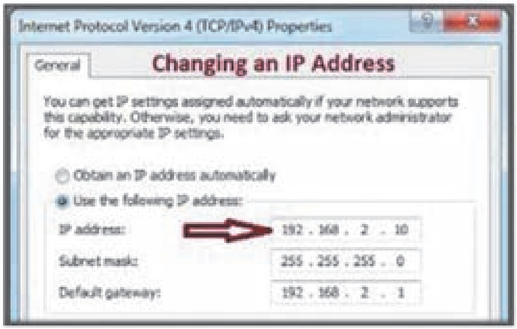


Figure 3.2 - Using IP addresses to identify computer in the Internet

These IP addresses are assigned by an Internet Service Provider (ISP). An Internet Service Provider (ISP) is a company and it provides access to Internet. For this, the ISP charges a fee for the service.

3.1.4 what is a domain name?



Let us consider the domain name edupub.gov.lk of the Uniform Resource Locator given above. Here gov represents the government and lk represents Sri Lanka. Thus, lk domain which comes after gov domain is the top level domain name. Domain name gives an identity to all the websites which exist in the Internet.

Following are the names used to represent the fields which the domains belong to.

Domain	Meaning
com	Commercial
org	Non profitable organizations
gov	Public
edu	Education
net	Web

The following country domains are used to represent the country related to the domain.

Domain	Meaning
in	India
au	Australia
jp	Japan
uk	United Kingdom
us	United States

The domain at the right - most corner of a domain name is called the Top Level Domain.

Example

URL	Domain Name	Top Level Domain
http://www.google.com	google.com	com
http://www.edupub.gov.lk	edupub.gov.lk	lk
http://www.nie.lk/pages/syllabus.asp	nie.lk	lk
http://www.unicode.org/consortium/consort.html	unicode.org	org

3.1.5 How the Internet works

Humans, being different from computers, have difficulty in retaining lots of similar numbers in mind. Working with names is much easier for them and cause less errors. That is why we rarely see the numbers as URLs on the Internet. When a URL is entered to the browser to view a website, the request must first be translated from the readable written address into an IP address that can be routed. This translation is done by the Domain Name System (DNS).

If a request is made to connect to certain website, for example www.yahoo.com, the request is first sent to the DNS server to translate into the correct IP address of 209.191.122.70. The actual connection to the website is done with this IP address. This process happens behind the screen quickly that the user does not notice.

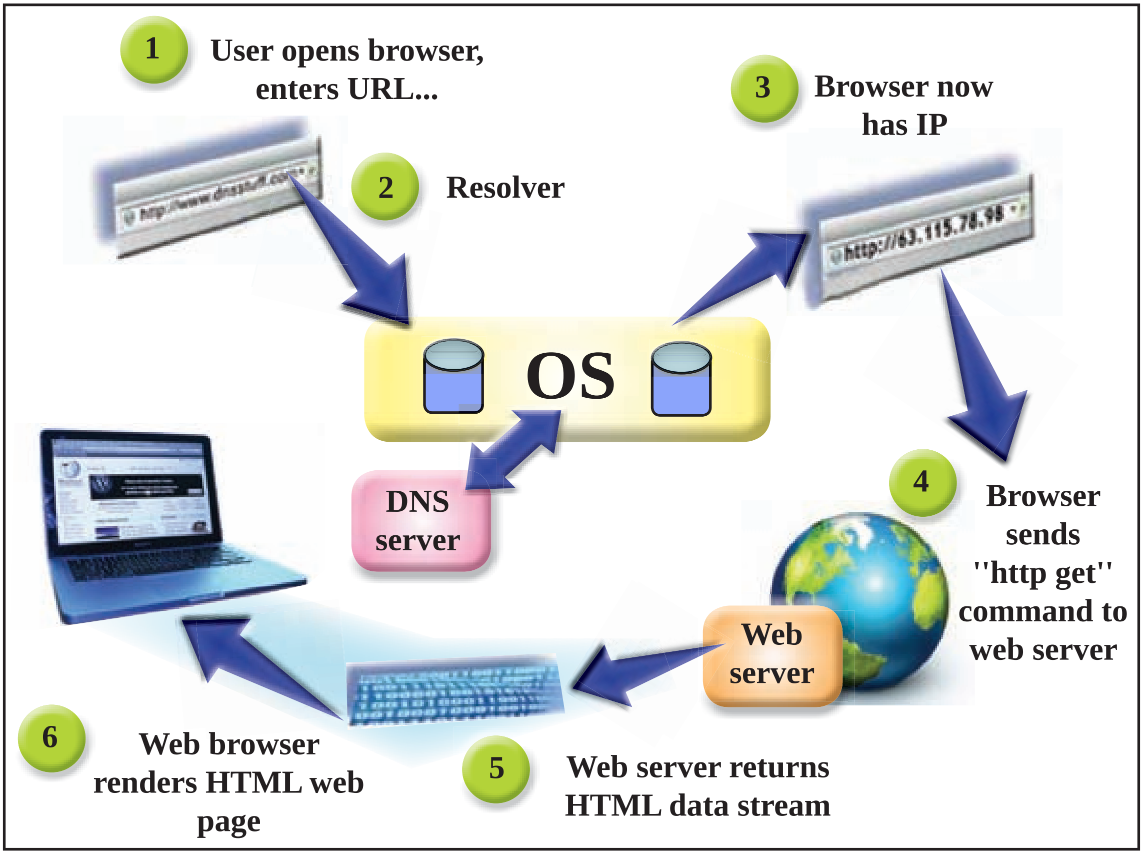


Figure 3.3 - Process how Internet operations are executed

The Internet, which does not possess any owner, is controlled by protocols. A protocol can be seen on a system of law operated in computer networks. Following are some protocols used in the Internet.

HTTP - Hypertext Transfer Protocol
TCP/IP - Transmission Control Protocol / Internet Protocol
FTP - File Transfer Protocol
SMTP - Simple Mail Transfer Protocol
ICMP - Internet Control Message Protocol

Protocol	Usage
HTTP	HTML document exchange
TCP/IP	Controlling the exchange of IP addresses
FTP	File exchange
SMTP	Electronic mail exchange
ICMP	Informing and controlling messages when there are errors

The Internet is a Wide Area Network (WAN) which is based on a Client Server Model. Hence, all the computers in Internet belong either to the type of servers or clients.

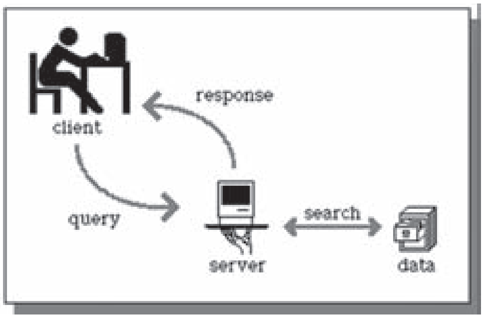


Figure 3.4 - Client server architecture in the Internet

The computer that distributes the resources required by the client computer is called the "server".



The activity of retrieving information from the server computers to client computers is called "downloading".



The activity of providing information from client computers to server computers is called "uploading".

Hence, transfer of information between server and client computers is two-way.

Let us identify some Internet server computers.

Web Server - Storing web pages and providing these to the client computers

Mail Server - Storing electronic mail and providing them to the client computers

DNS Server - translating URL to IP addresses

3.1.6 Services of the Internet

The following are some of the services of the Internet;

1. World Wide Web - WWW
2. File Transfer Protocol
3. Remote Access
4. File Sharing
5. Streaming of media
6. Search Engines
7. Electronic Mail - e mail

3.1.6.1 World Wide Web (WWW)



World Wide Web is a service provided by the Internet and it is a large collection of electronic documents saved in computers all around the world connected to the Internet.

Sir Tim Berners Lee is considered the father of www. A user who uses www can access web sites through a Web Browser.

A Web Browser is an application software. Following are some examples of Web Browsers.

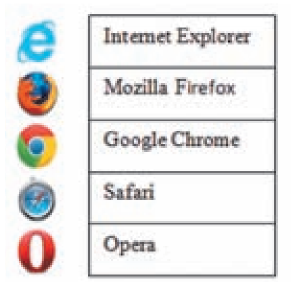


Figure 3.5 - Web Browsers

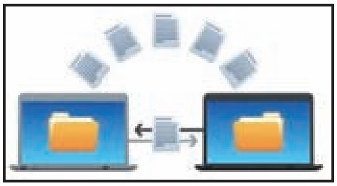
A web site consists of several web pages. There can be written text, images, videos and other multimedia and hyperlinks included in a web page. Use of hyperlinks makes browsing the web sites easy. To access a web site, Uniform Resource Locator – URL (web site address) should be typed on the address bar of the web browser and the ‘Enter’ key pressed. The page which contains the basic information about the web site is called the ‘Home Page’. The other pages of the web site can be accessed through the hyperlinks included in it.

For instance, let us consider the official web site of the Department of Examinations, Sri Lanka.



Figure 3.6 - Home page of the website of Department of Examinations, Sri Lanka

3.1.6.2 File Transfer Protocol (FTP)



File of smaller size can be sent with an e mail as an attachment. But files with larger capacities cannot be sent in an e mail attachments.

FTP is used to transfer large files of one computer in the Internet to another computer. This protocol is operated on TCP/IP and used to upload files of a client computer to the Internet and to download files from server computers in the Internet.

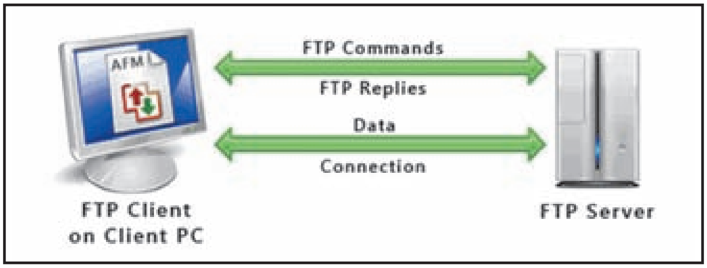


Figure 3.7 - File transfer system

3.1.6.3 Remote Access

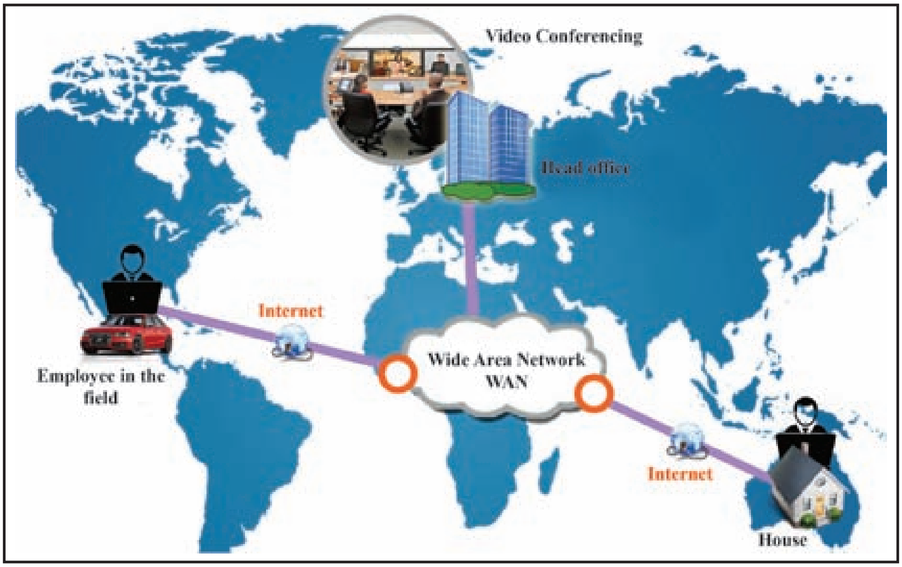


Figure 3.8 - Remote access

Controlling and operating a computer in the Internet remotely is performed through remote access. Following are certain functions which can be performed through Remote Access after accessing the Internet.

1. Installing software of server computers to client computers.
2. Fixing problems on client computers.

Using remote access functionality sometimes hackers steal important data and information stored on computers without owner's knowledge (This is called hacking).

3.1.6.4 File Sharing



The main objective of computer networking is to share resources. Such resource sharing includes file sharing. Thus, sharing of various files in the Internet take place often.

Example

1. When you check exam results on line, that file is accessed by a large number of clients at the same time.
2. Thousands of users can be connected to a web site at the same time.

3.1.6.5 Streaming of Media

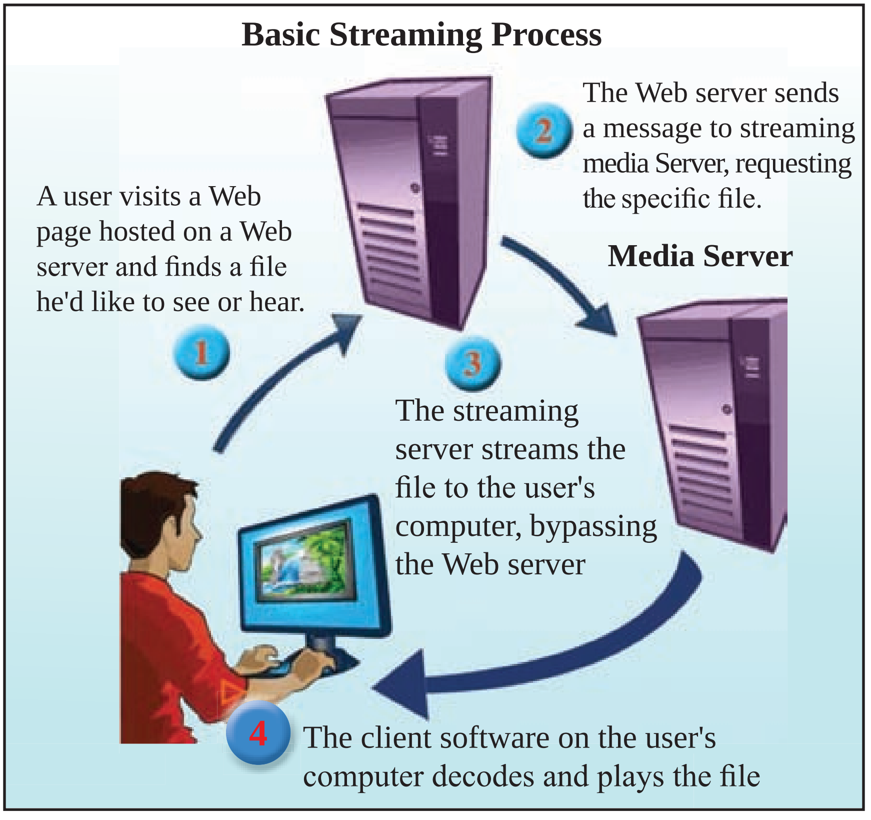


Figure 3.9 - Streaming of media

Internet provides much assistance to share all sorts of information which consists of multimedia such as text, images audio and video. Downloading images, songs and videos etc from the Internet can be considered as an example.

3.1.6.6 Search Engines



Web sites largely contain information on the Internet. These websites should obtain information. For this, you should know the address (URL) of the web site. However, the unlimited number of websites in the Internet makes it practically very difficult.

Search engines are designed for the Internet users to find any information easily.

After typing the key words in the search box of the search engine and clicking the search button, you will get a large number of web sites with hyperlinks which contain the information you need. You can obtain the necessary information by clicking one or several hyperlinks.

Given below are some examples of search engines used often.

http://www.google.com or http://www.google.lk
http://www.yahoo.com
http://www.ask.com
http://www.msn.com

3.1.7 Domain Name Server

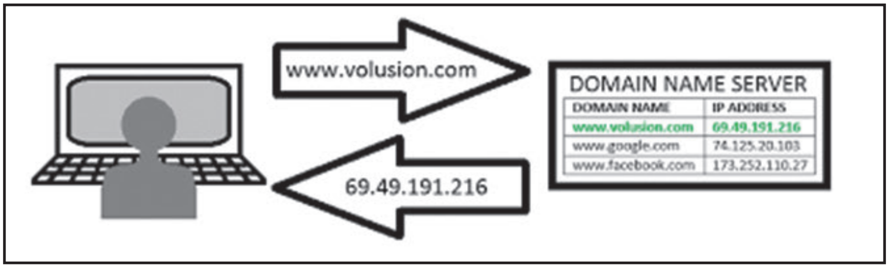


Figure 3.10 - Domain names are converted to IP address by domain server

Domain name is used to uniquely identify a web site. This makes the users remember it somewhat easily. However, an IP address is used to uniquely identify a computer on the Internet. What the Domain Name Server does is converting the domain name to an IP address.

3.2 Using Internet for communication

3.2.1 Electronic Mail

Electronic mail enables exchanging messages as electronic mails or files between two or more people. There are several organizations which provide e mail service free of charge through the Internet. Hence, the cost is only for the use of the Internet. This is the cheapest and fastest communication method in the world.

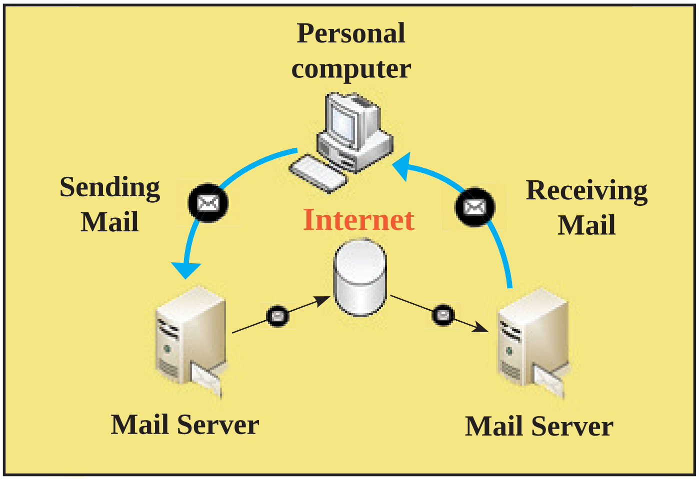


Figure 3.11 - Exchange of e mails in the Internet

Any person in the world can create an electronic mail account through the Internet and this can be used to identity this person within the Internet.

An electronic mail address takes the form as follows.

Let us consider the email address of the Department of Examinations, Sri Lanka for instance.

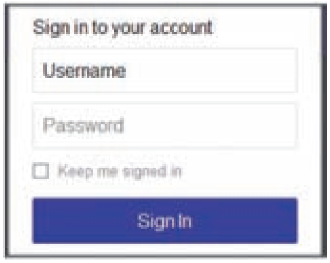
exams@doenets.lk

↑ User name   ↑ Domain name

Here, exams is the user name and doenets.lk is the domain name. @ symbol separates the user name and the domain name.

It is essential for the sender as well the receiver to have email accounts.

An electronic mail account should be created before using an electronic mail. The web sites which provide electronic mail services on the Internet provide facilities free of charge. It is essential for an electronic mail (e mail) account to have an email address and a password. The email account should be opened to send mails or to check the received mails. User name and password should be entered accurately for this and then click 'Sign In'.



Sending an email

Sending an e mail can be performed in the following manner.

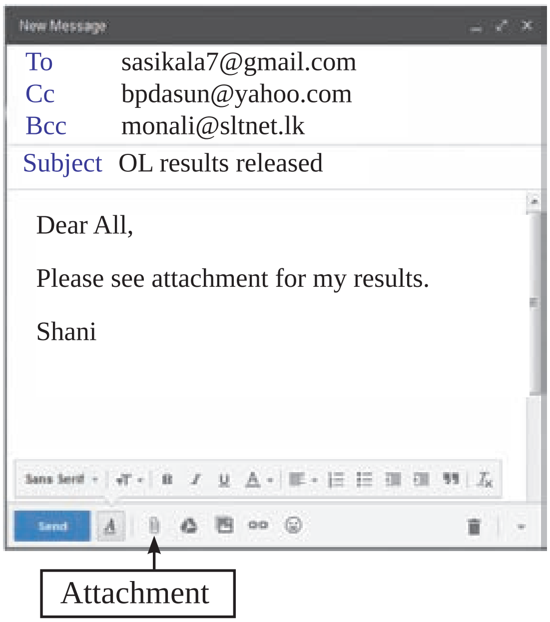
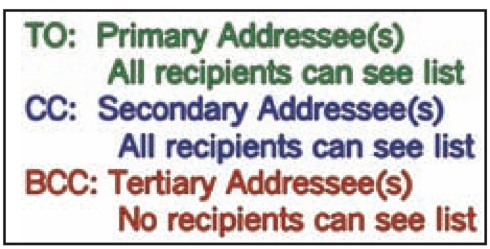


Figure 3.12 - sending an e mail

- Type the receiver's email address in To (sasikala7@gmail.com)



- Type the email address of the others (bpdasun@yahoo.com) who should receive the copies of the email in Cc (Carbon copy)
- Type the email addresses of those who should receive the mail without the awareness of those receivers typed

under To and Cc in Bcc (Blind carbon copy). Those who receive Bcc copies can view all the receivers of the mail. However, the receivers typed under To and Cc cannot view the receivers of Bcc copies (monali@sltnet.lk)

- The person who receives Bcc copy (monali@sltnet.lk), can see all the e mail addresses (sasikala7@gmail.com) and (bpdasun@yahoo.com) that this letter sent. Persons under To and Cc (sasikala7@gmail.com) and (bpdasun@yahoo.com) cannot see the e mail address of Bcc
- Type the title or relevant subject related to the mail in Subject. (O/L results released)
- Attach other file or files which should be sent with the e mail by clicking the attachment button with the paper clip icon. (Results.jpg)
- Send the email by clicking "Send".

e mails are categorized inside an e mail account for easy use.

- Inbox - To store mails received
- Drafts - To store mails that are composed to be sent but could not be completed
- Sent - To store mails sent
- Trash/Deleted - To store mails for a certain period that are deleted
- Spam/Junk - To store mails that are unwanted

Unwanted e mails stored in a separate folder without disturbing the Inbox are known as Spam.

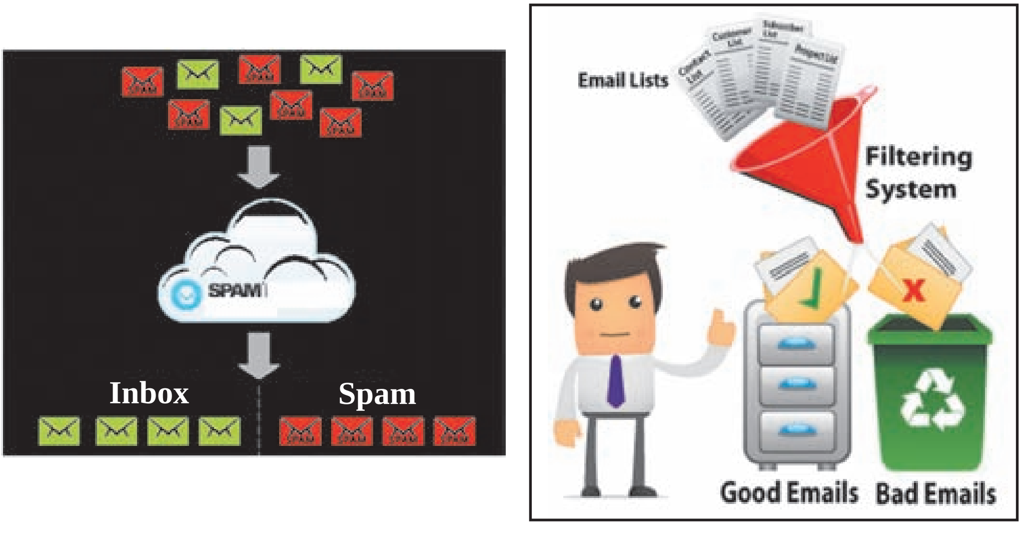


Figure 3.13 - Spam mail

3.2.2 Sending instant messages - IM

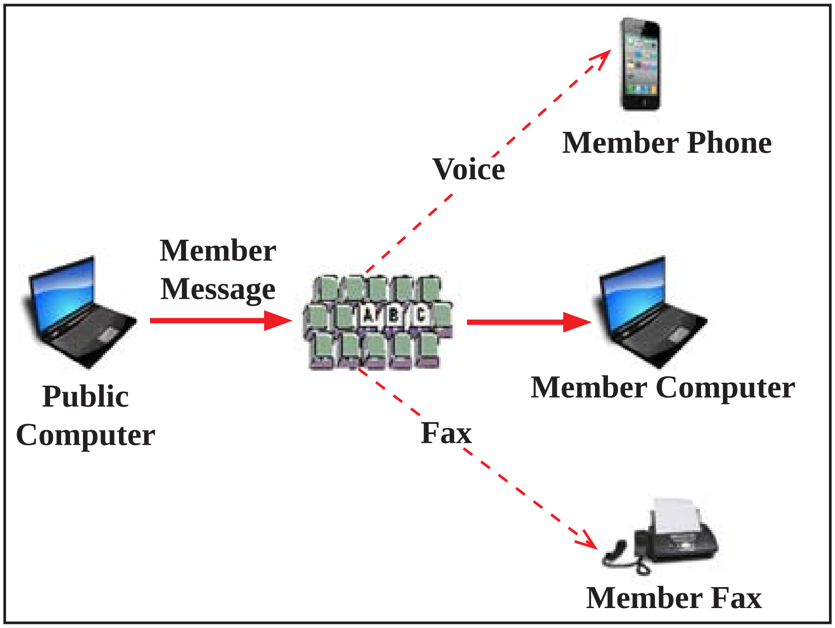


Figure 3.14 - Sending instant messages

Two persons can exchange short messages very fast (chat) over the Internet using the chat facility.



Figure 3.15 - Tools for sending instant messages

3.2.3 Video conference

Video conferencing is conducting a conversation between two or more persons in different (remote) locations using audio and video transmission over computer networks.



The requirements are as follows for a video conference

- Computers
- Web cam
- Internet connection
- Communication software (with audiovisual facilities)

3.2.4 Social Networks



Social networks are, used to maintain social relationships over the Internet.

These social networks facilitate the people to exchange personal details, photographs, videos and daily activities. As a result, social relationships are widened and also can create social issues.

Given below are some examples of social networks.

http://www.facebook.com

http://www.twitter.com

http://www.youtube.com

http://www.flickr.com

http://www.pinterest.com

http://www.secondlife.com

3.3 Cloud Computing



Cloud computing is the practice of using a network of remote servers hosted on the Internet to store, manage and process data, rather than a local server or a personal computer. The main services of cloud computing are

- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Software as a Service (SaaS)

Infrastructure as a Service (IaaS)

This provides a virtual environment of servers to provide space to store data and software applications with the help of server computers and also to provide various resources through the use of large data centres established.

E.g. - Obtain the facilities of server space and firewall through cloud computing even though you do not own them

Platform as a Service (PaaS)

This platform provides necessary server environment for software development. This gives facilities including operating system, programming language environment, database and web server.

E.g. - Software can be developed in the cloud computer service even though you do not have installed operating system or compilers in your computer.

Software as a Service (SaaS)

This provides software installed in cloud without installing the software required by the user.

This reduces the cost and complexity of buying and managing hardware and developing software needed for software by the user.

E.g. - In Android devices, word processing software, spreadsheet packages etc that can be used not by installing them in the device but using a web browser.

Advantages and Disadvantages

Advantages	• Lower software cost • Improve performance • Fewer maintenance issues • Instant software updates
Disadvantages	• Requires a constant Internet connections • Does not work well in low speed Internet connections

Activity

1. Match A and B columns

A column	**B** column
e mail address	doenets.lk
Domain name	172.92.83.106
Uniform Resource Locator	somasiri@gmail.com
IP address	http://www.nie.lk/syallabus/ol/ict.pdf

A column	**B** column
Web address	Converts domain name into IP addresses
A service in the Internet	Google
Domain name	Mozilla Firefox
Search engine	World wide web

Summary

- Uniform Resource Locator (URL) helps identify resources available in the web sites uniquely.
- IP addresses help identify every computer in the Internet uniquely.
- To identify a web site, the domain name is used.
- Domain name server transforms the domain name into an IP address.
- All connections on the Internet are performed using protocols.
- World Wide Web and e mail are some of the main services provided by the Internet.
- To view the web pages, web browsers are used.
- Search engines are used to find information in the web.
- e mail is the fastest and the cheapest method of communication.
- an e mail address is unique.
- Instant messages, video conferencing and social media are also used in communication.

4 Use of Multimedia

After studying this chapter, you will understand the following:

- The basics of digital graphics
- Graphic size and compression
- Graphic types
- Basics related to graphic design
- Fundamentals of animation
- Geometric objects and shapes
- Types of frames
- Multimedia animation
- Multimedia distribution
- Audio recording
- Multimedia editing
- Audio/Video mixing towards animation

4.1 Digital Graphics

From times immemorial man practiced the art of drawing and colouring to portray a beautiful idea, or a visual that left a lasting impression. Ancient wall paintings remind us about the important role played by artistry in conveying ideas. Pictures formed the basis of communication. At the same time, available pictures make us realize the difficulties our ancestors would have faced to convert an idea into an illustration. There would have been many drawbacks in mixing of colours. Yet, they overcame such drawbacks to leave behind the paintings seen today.

However, with the development of technology and the availability of software for digital graphics, it is now possible to create various graphical illustrations and edit them. Using such software for graphics is quite simple and interesting.

Drawings or images, created with the use of computer graphic software, are called digital graphics.

Let us identify the fundementals of digital graphics (fig. 4.1).

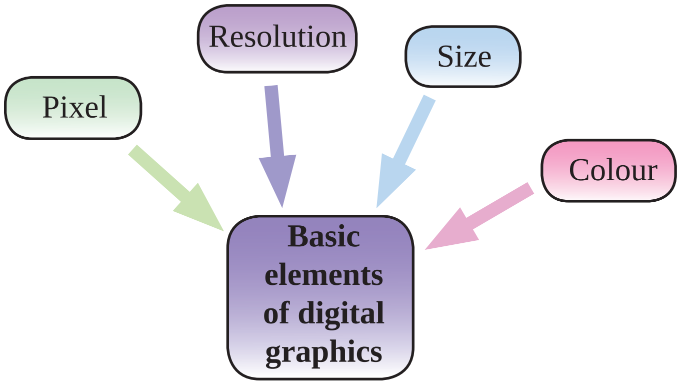


Figure 4.1 - Basic elements of digital graphics

• Pixel

A pixel is a tiny illuminated dot having a colour which is displayed on a computer screen. The digital graphics are created with thousands of such pixels.

These pixels get arranged in rows or columns close to each other to produce graphical image (fig. 4.2). A digital graphic is an array of rectangular pixels called a bitmap.

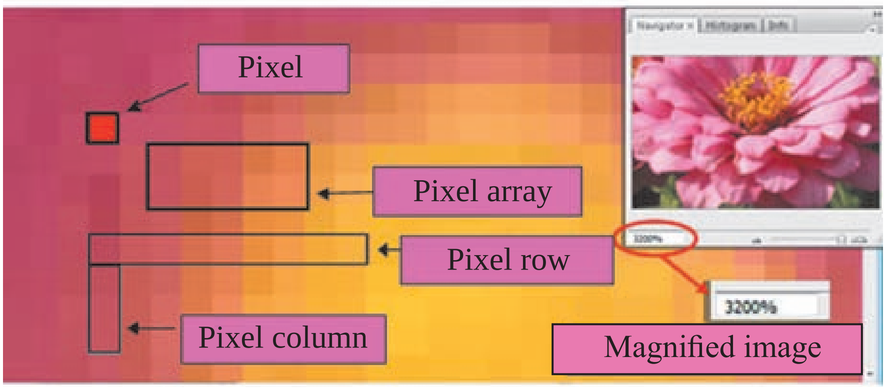


Fig 4.2 - Pixel

The size of a graphic can be increased or decreased to fit into a computer screen or a printing paper. In changing the size of the original graphic, the size of the pixel is changed. When the graphic has a smaller number of pixels its quality decreases when it is enlarged (fig 4.3).



Fig 4.3 - Decrease in quality in an enlarged graphic

Colours used in a graphic are represented by the number of bits per pixel (bpp) used. Graphics which use more bits per pixel are higher quality.

• Colours in a pixel and the number of bits

The number of bits per pixel determines the colours used in an image.

A single bit represents two colours	Two bits represent four colours
0, **1** } two colours	**00**, **01**, **10**, **11** } four colours

However, by observing a graphic, it is not possible to determine the numbers of colours per pixel used. The number of bits used for the pixel only help find out the number of colours per pixel used. The following function can be used for the purpose.

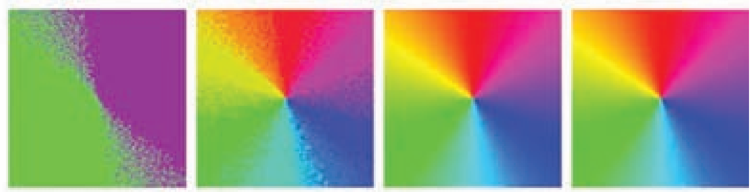
Colour per pixel used = $(2)^{bpp}$ (bits per pixel)

E.g. - If a pixel has 4 bits,

Colour used on the pixel = $(2)^4$
= $2 \times 2 \times 2 \times 2$
= 16 colours

To find the number of bits when the colours are known:

The number bits per pixel = $\sqrt{\text{colour}}$
= $\sqrt{16}$
The number of bits per pixel = 4



Bits per Pixel	function	Number of colours
1 bpp	$(2)^1$	2
2 bpp	$(2)^2$	4
3 bpp	$(2)^3$	8
4 bpp	$(2)^4$	16
5 bpp	$(2)^5$	32
6 bpp	$(2)^6$	64
7 bpp	$(2)^7$	128
8 bpp	$(2)^8$	256
10 bpp	$(2)^{10}$	1024
16 bpp	$(2)^{16}$	65536
24 bpp	$(2)^{24}$	16777216 (16.7 million colours)
32 bpp	$(2)^{32}$	4294967296 colour (4294 million colours)

• Resolution

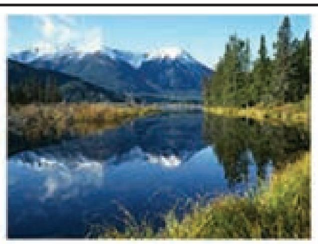


Fig 4.4 - Image Resolution

Pixels are used to measure the physical dimension of a digital graphic. The physical dimension is displayed as the image resolution.

This illustration in Figure 4.4 is 250 pixels wide and 175 pixels high. The image resolution, therefore, is 250 x 75 pixels or 43,750 pixels.

A high resolution digital graphic using a large number of pixels is higher in quality. To determine the quality of a graphic the number of pixels per inch (ppi) used (horizontal or vertical) or the number of dots per inch (dpi) used (horizontal or vertical) are considered. (Figure 4.5)

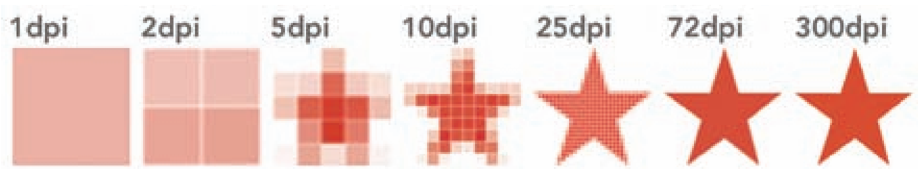


Fig. 4.5 - Number of dots per inch (dpi)

- **Colour**

A digital graphic contains tens of thousands of pixels. Each pixel represents a colour. Therefore, a pixel is a small dot with a colour.

There are about 16 million of recognizable colours visible to the naked eye. This number comes from a mixture of colours. However, it is difficult to correctly recognize each colour. (figure 4.6)

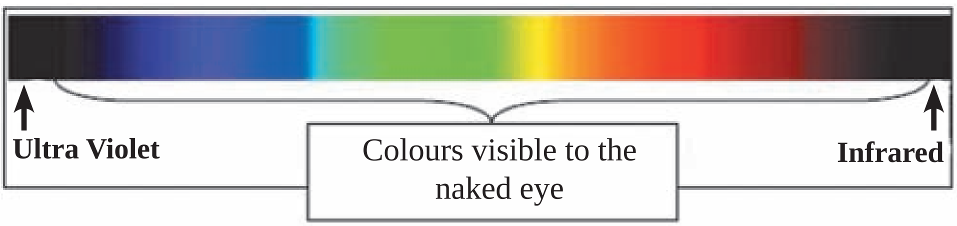


Fig 4.6 - Colours visible to the naked eye

In designing digital graphics it is possible to use many colours. The colour model which should be used for the design must be decided based on the output device or the media. (figure 4.7)

Two widely used colour models are shown on figure 4.7

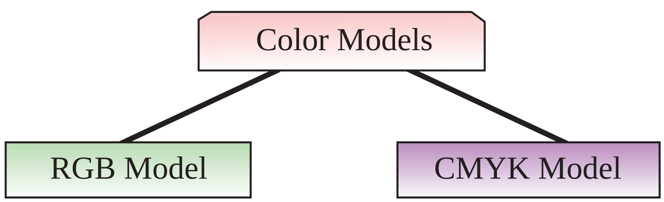


Fig 4.7 - Colour Models

- RGB Model – This is widely used to create images on television screens or computer screens using coloured lights. The Primary Colours used here are **R**ed, **G**reen and **B**lue.
- CMYK Model – This model is used for printing on paper using coloured inks. The Primary Colours used here are **C**yan, **M**agenta, **Y**ellow and **B**lack.

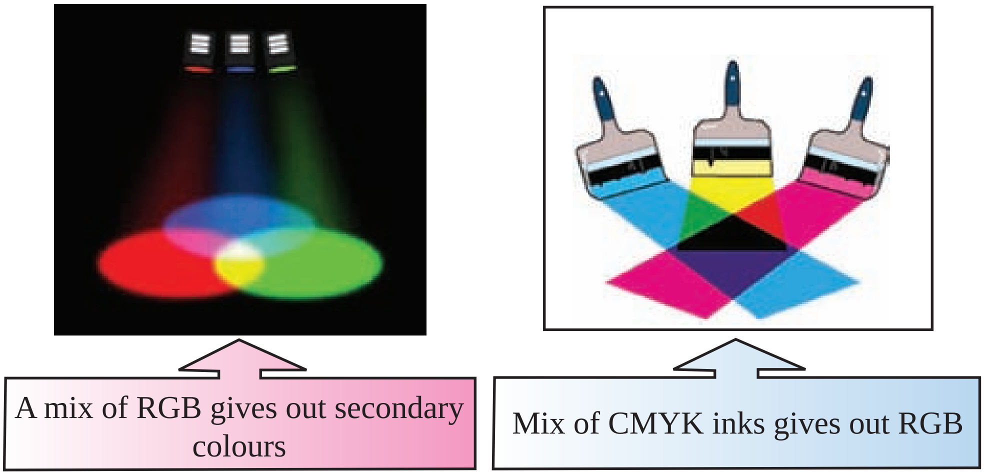


Fig 4.8 - Mixing colours

Colours are very useful to maintain the quality of the picture or illustration. Single colours are known as primary colours. Colours made by mixing two colours are known as secondary colours while tertiary colours are made by mixing three colours. There are 256 (0 - 255) colour variations in a primary colour.

Forming a tertiary colour

To make a tertiary colour, the colour combination should be from 000, 000, 000 to 255, 255, 255. This is known as RGB Triplet and it can be represented in octal numbers as RGB (245, 102, 36) or RGB (F5, 66, 24). (Figure 4.9)

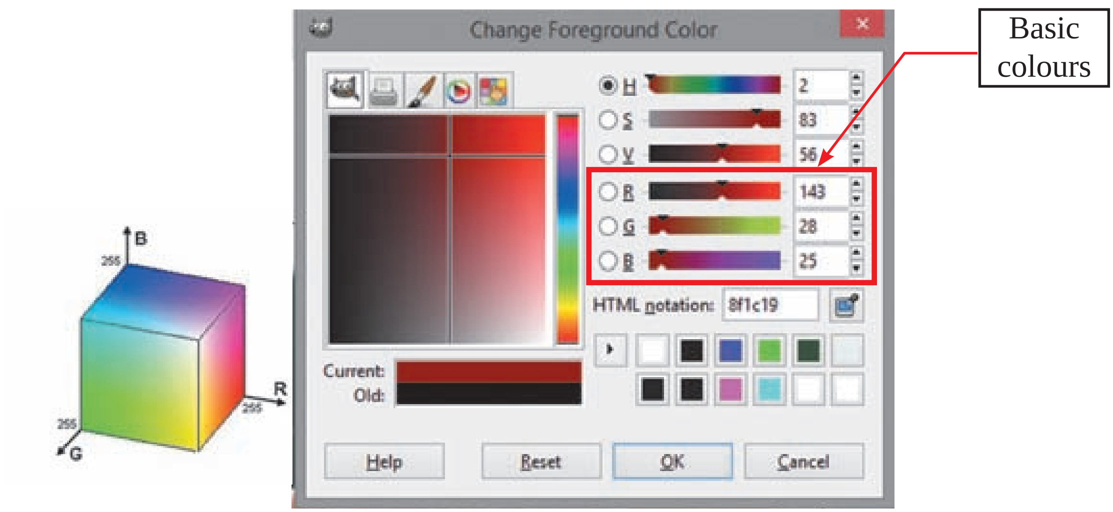


Fig 4.9 - tertiary colour mixture

Graphic size and compression

The size of a graphic is determined by the number of pixels, the number of lines and the colour combinations used for the creation. A graphic with a large number of pixels, colours and a high resolution has a large file size. There may be difficulties in storing and transmission of such a graphic. Graphic compression is used to compress file size. Compression can be carried out at the time of saving the graphic or later.

The file formats used for compression in saving a graphic may or may not cause affect to the original quality of the graphic. The file formats are created using different algorithms to suit the compression.

There are two methods for graphic compression - Lossy compression and Lossless compression. (Figure 4.10)

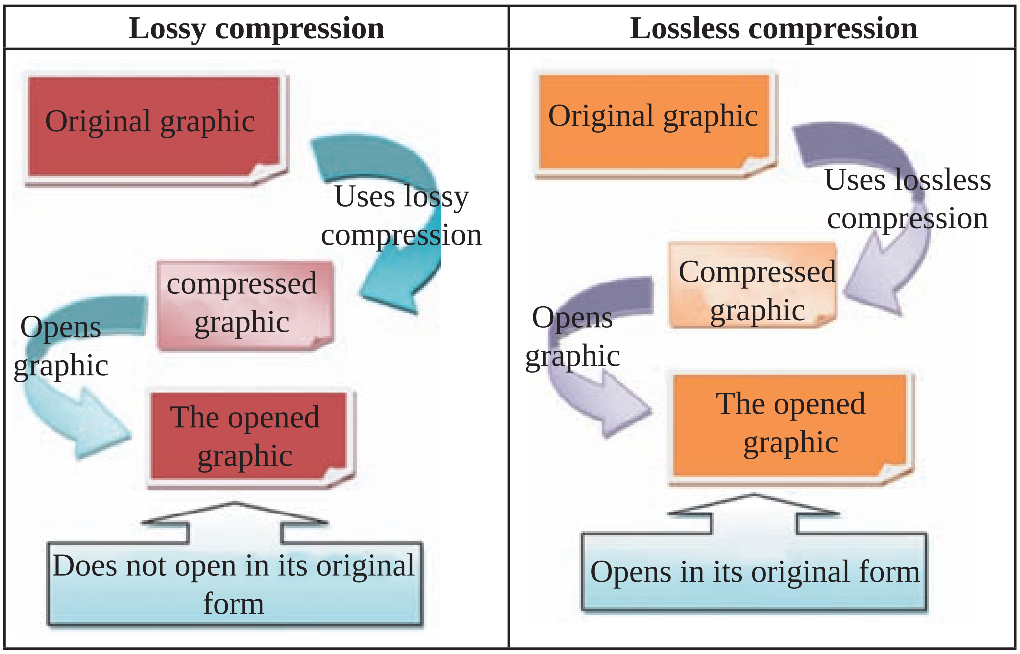


Fig 4.10 - Use of Compression methods

It is possible to compress graphics to a minimum size using Lossy file formats, but this compression reduce the quality of the original graphic. The reopened graphic does not show its original form. Yet, to make it faster for compression and for saving and downloading from the Internet, Lossy compression is useful. JPEG, TIFF, BMP are a example for Lossy file formats.

On the other hand, it is possible to compress a graphic preserving its original quality. In opening such a file, it is displayed in its original quality. This compression is identified as Lossless format. GIF, PNG, RAW are examples for Lossless file formats.

Graphic Types

Digital graphics fall into two main categories. They are raster graphics and vector graphics. The type of graphic (raster or vector) is decided according to the graphical software used.

There is a difference between Raster graphic and Vector graphic. Let us identify them.

Criteria	Raster graphic	Vector graphic
Creation of the graphic	Array of pixels in different colours	By collection of straight or curved lines
File records	No records	Maintains a record of the start and the end, number of lines, straight and curved lines and colours used
Quality of the graphic	Quality is lost when the size changes	Quality is not lost when the size changes
For high quality creations	Not suitable	Suitable
Creation and saving	Uses less memory space	Needs more memory space
Computer speed in creation	Does not change	Reduces
Examples of software	Adobe Image Ready, Adobe Photoshop, ProArtRage, Artweaver, Corel PHOTO-PAINT, GIMP, Deluxe Paint, GIMP shop, Microsoft Photo Editor	Adobe Illustrator, Adobe Live Motion, Corel Paint Shop Pro, Adobe Fireworks, Microsoft Expression Design, DrawPlus, X ara Photo & Graphic Designer, CorelDRAW, Litha-Paint

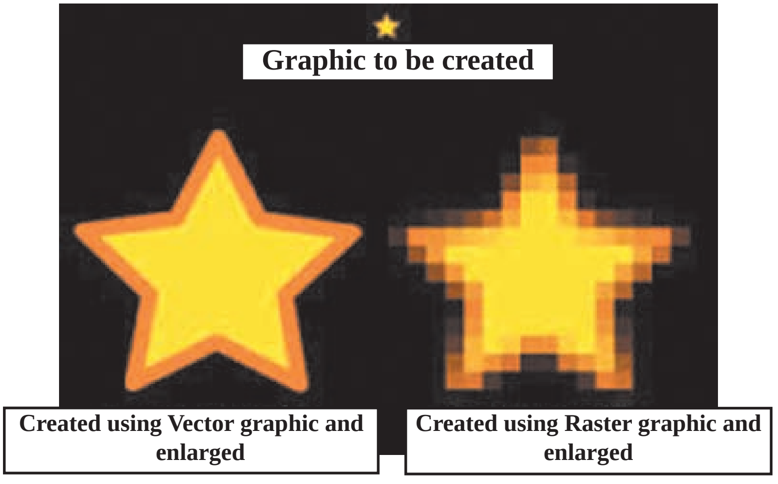


Figure 4.11 - Difference between raster graphics and vector graphics

Graphic Design

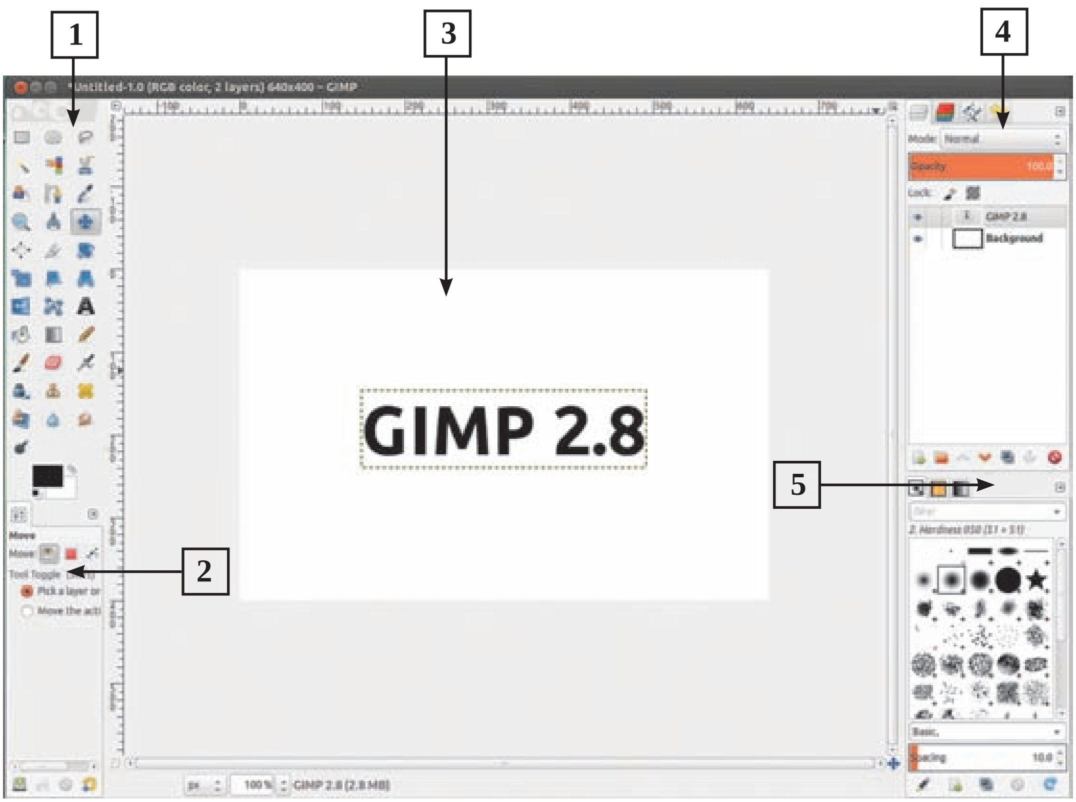
There are many software types for the creation of static graphics. A few of them were mentioned earlier. Most of such software need to be purchased while some may not be compatible for all Operating Systems. Therefore, let us see a software that comes free and can be downloaded from the Internet.

GIMP

GIMP is an image manipulation program created for GNU free and open source operating system. This free software is widely used to reconstruct photographs, create graphics, edit and formatting of graphics. This software with many tools helps with the creation a simple graphic as well as to edit a high quality photographs. GIMP software belongs produces raster graphics.

GIMP software is UNIX based. It can also be installed on Microsoft Windows and Mac Operating system to install GIMP on a computer, go to http://www.gimp.org/downloads/.

GIMP - Graphical User Interface



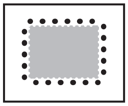
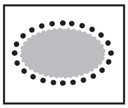
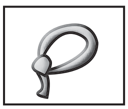
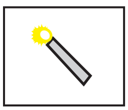
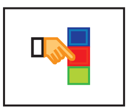
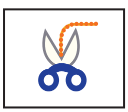
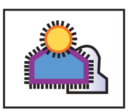
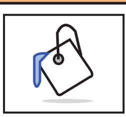
1. The Main Toolbox
2. Tool Options
3. Image Window
4. Layers, Channels, Paths
5. Brushes/Patterns/Gradients

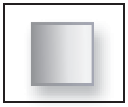
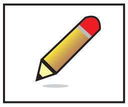
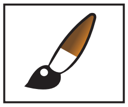
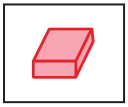
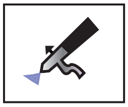
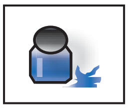
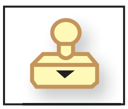
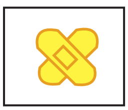
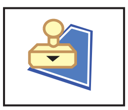
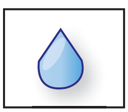
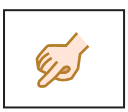
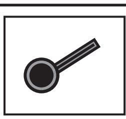
1. The Main Toolbox

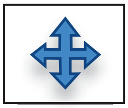
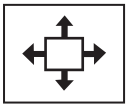
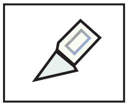
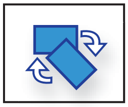
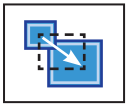
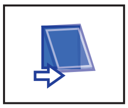
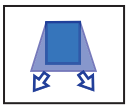
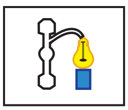
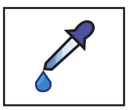
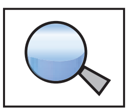
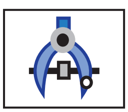
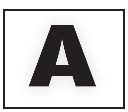
It is possible to open or close the tools in this box for the editing graphics.

For the purpose, follow:

Edit → Preferences →Toolbox →
The tools can be enabled or disabled.

Icon	Name of the tool	Shortcut	Description
	Selection tools		
	Rectangle	R	Selects the required area as a square or rectangular region.
	Ellipse	E	Selects the required area as a circular or elliptical region.
	Free (Lasso)	F	Draws free-form selections
	Fuzzy (Magic Wand)	U	Selects areas on color similarity.
	By Colour	Shift + O	Selects all instances of a colour in a graphic.
	Scissors	I	Creates paths to select shapes
	Foreground	-	Selects a region containing foreground objects.
	Brush Tools		
	Bucket Fill	Shift + B	Fills an area with a colour or a pattern.

	Blend (Gradient)	L	fills the selected area with a gradient blend
	Pencil	N	Paints hard-edged lines; that is, the pixels are not anti-aliased.
	Paintbrush	P	Paints soft-or fuzzy-edged lines; that is, the pixels are anti-aliased and/or feathered.
	Eraser	Shift + E	Erases pixels from a layer.
	Airbrush	A	Paint tool with variable pressure to spray colours on a graphic
	Ink	K	Adds colour to a graphic, like the paintbrush. Quick movement of mouse minimizes the size of brush. Slow movement makes its vice versa
	Clone	C	Copy pixels from one part of a graphic to another.
	Heal	H	Resolves image irregularities removing unnecessary colours and spots
	Perspective Clone	-	Clones from an image source after applying perspective transformation.
	Convolve (Blur/Sharpen)	Shift + U	Blurs or sharpens an image
	Smudge	S	Dampens graphic
	Dodge/Burn	Shift + D	Lightens or darkens an image's shadows, mid tones, or highlights.

Transform Tools			
	Move	M	To shift or move a selection
	Align	Q	To align or arrange layers or objects
	Crop	Shift + C	Crops or clips the image
	Rotate	Shift + R	Rotates the active layer, selection or path.
	Scale	Shift + T	Scales the active layer, selection or path
	Shear	Shift + S	Shifts part of the image in some direction.
	Perspective	Shift + P	Changes the perspective of the active layer, selection or path
Other Tools			
	Path	B	Allows selecting and modifying paths
	Colour Picker	O	Selects the colour of any image opened on your screen.
	Magnify (Zoom)	Z	Alters the zoom level of the image
	Measure	Shift + M	Shows distances and angles
	Text	M	Places text into the image.

2. **Tool Options:** The Tool Options are available to customize the options for a tool.

3. **Image Window:** Helps display the graphic created. It is possible to keep several windows open to suit selection. In this situation several windows will be open at the same time. Or else one window can be kept open and use others as necessary. For this purpose, select:

   Windows → Single-Window Mode

4. **Layers, Channels, Paths:** These are shown as Tabs and can be clicked open when necessary.

5. **Brushes/Patterns/Gradients:** These tabs help create and add colour to a graphic.

Basics of a Graphic software

Opening a new window for a graphic →

- Click 'File' → 'New'
  The 'New Image' dialogue box opens.
- Select the size of the graphic
- Either adjust height and width or select a template
- Click 'OK'

To save a graphic created →

- Click 'File' → 'Save'
- Give name to the graphic in 'Save Image' dialogue box
- Select a saving location from 'Places'
- Click, 'Save'

> Note: Graphics Created in GIMP are saved in XCF (file extension)
> (**Eg:** image 1.xcf)

Export Graphic →

- Select File → Export
- Give a Name for the graphic in 'Image' dialogue box
- Select suitable saving Location from 'Places'
- Select File Formats from 'Select File Type (By Extension)'
- Click, Export

(Compression takes place to suit different file types)

Opening an existing window

- Click 'File' → 'Open'
- From the dialogue box 'Open', select saving location from 'Places'
- Select the saved graphic from, 'Names' window.
- Click 'Open'

Using GIMP software

1. Creating a graphic using several pictures

- The following methods can be used to obtain images for graphic creation.
- scanned pictures saved in the computer
- Images captured on a digital camera saved in the computer
- Images captured on a digital camera in a smart phone and saved in the computer.



The above graphic shows a creation with three different images. It is created as follows:

You may use images stored in the computer or select an image that can be obtained easily.

Step 1 - Open GIMP software

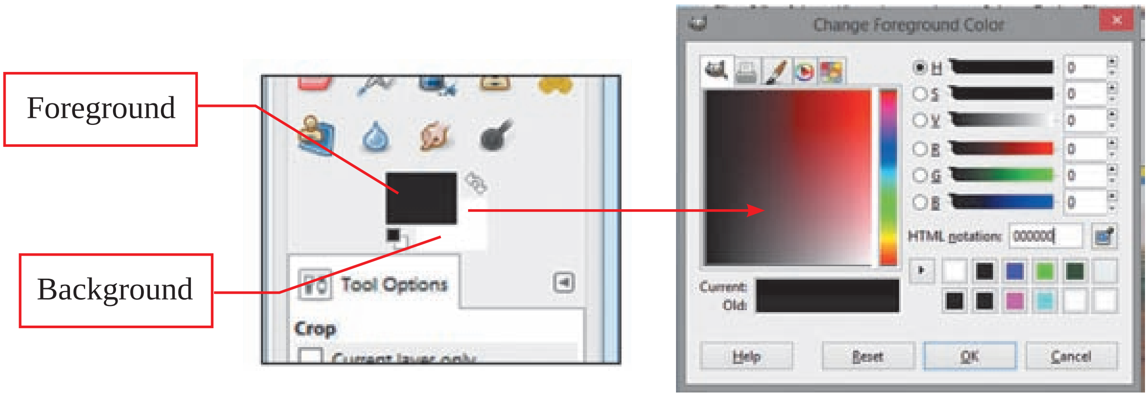
Step 2 - From the Menu, select 'Windows' → 'Single - Window Mode'

Note: GIMP software contains two window types for use. One is Single-Window Mode and the other, Multi Windows Mode. The window has to be changed before the graphic is created.

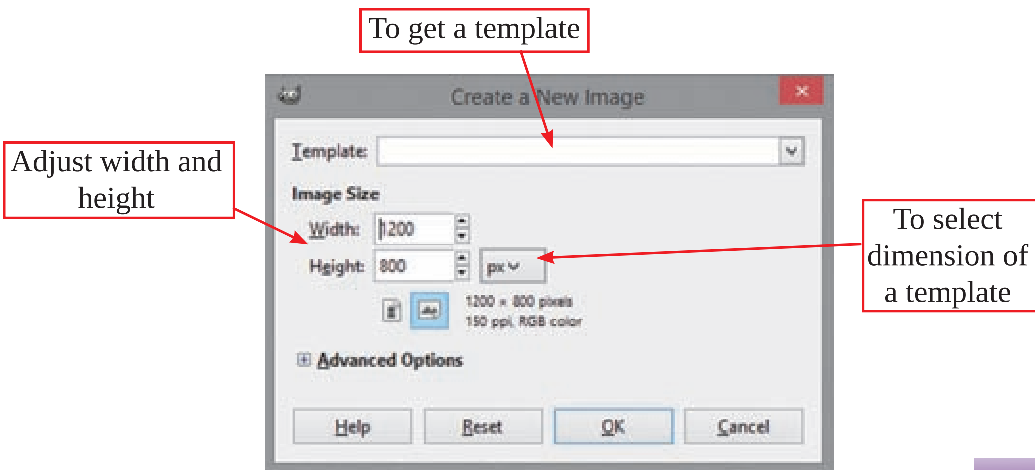
To obtain images,

Step 3 - Click 'File' → 'Open' and from the dialogue box and open pictures for work. Pictures need to be opened one at a time. Therefore, do not select ‘Open as Layers’.

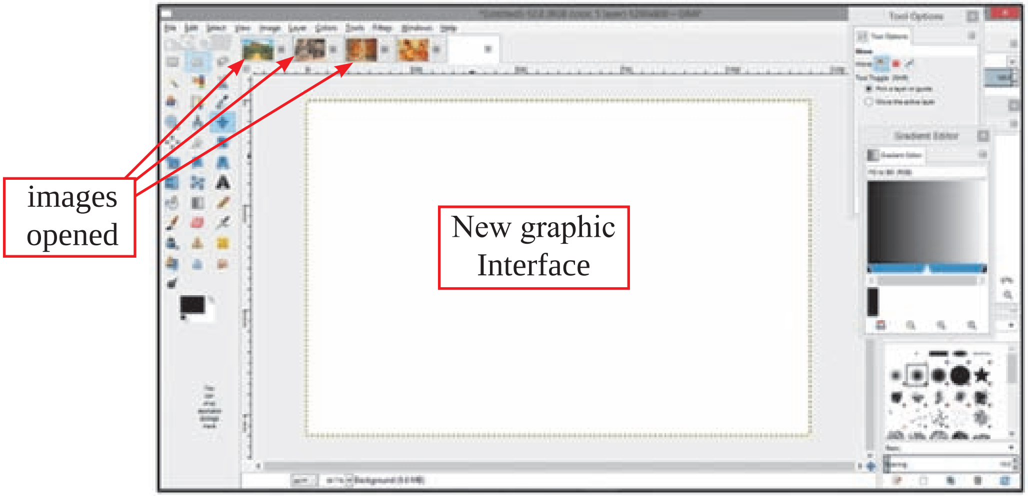
Step 4 - From the Tool Options, select foreground and background as black and white. For this, follow the illustration and click on the colour in the colour box. Or else, with HTML notation, use 000000 for black and ffffff for white using the keyboard. Click 'OK'.



Step 5 - To open a window for a graphic, click on 'File' → 'New'. In the 'Create A New Image' dialogue box, indicate width as 1200 and height as 800 px and click 'OK'. (Templates can be used for other scales.)



Once adjusted, it opens a GIMP Interface as follows.



Step 6 - Select the first image. Right click on the related Layers. Select 'Add an Alpha Channel'.

The Alpha Channel helps make the picture transparent. With the second picture, this transparency comes in automatically. However, when there is only one picture in the Layer window, it is necessary to select 'Add an Alpha Channel.

Step 7 - Select 'Ellipse' from Tool Option. Click 'Tool Options → Feathers' and mark the ellipse on selected picture.

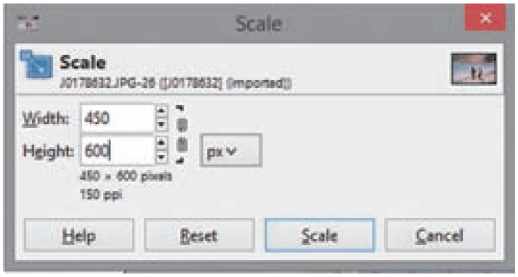


Step 8 - 'Select → Feathers' Make 'Feather' to 10 pixels Click 'OK' Select 'Edit → Copy Visible'



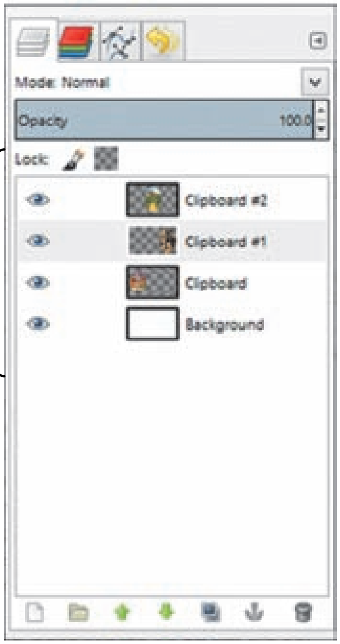
Step 9 - Click on new graphic window
Select, 'Edit' → 'Paste as' → 'New Layer'
The prepared section of the image appears on the new graphic window.
Using Move Tool, to position the image on the window.

Step 10 - It is suitable to have all images in the same size. For this, select 'Scale' tool from Tool Options.
Click on image
In the Scale dialogue box, arrange the width and height of the image as 450, 600 pixels. Click, Scale.



Step 11 - Follow steps 5, 6, 7, 8, 9, 10 and 11 to bring the other two pictures too to the graphic window. Position them and scale.

The positioning of layers is shown in this manner.



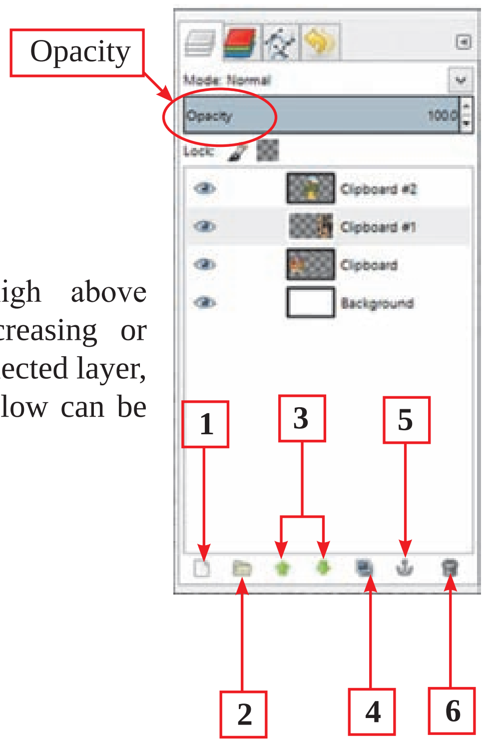
Layers

The use of Layers is important for both simple and complex graphic creations. It is easy to manipulate objects on a graphic by using different layers.

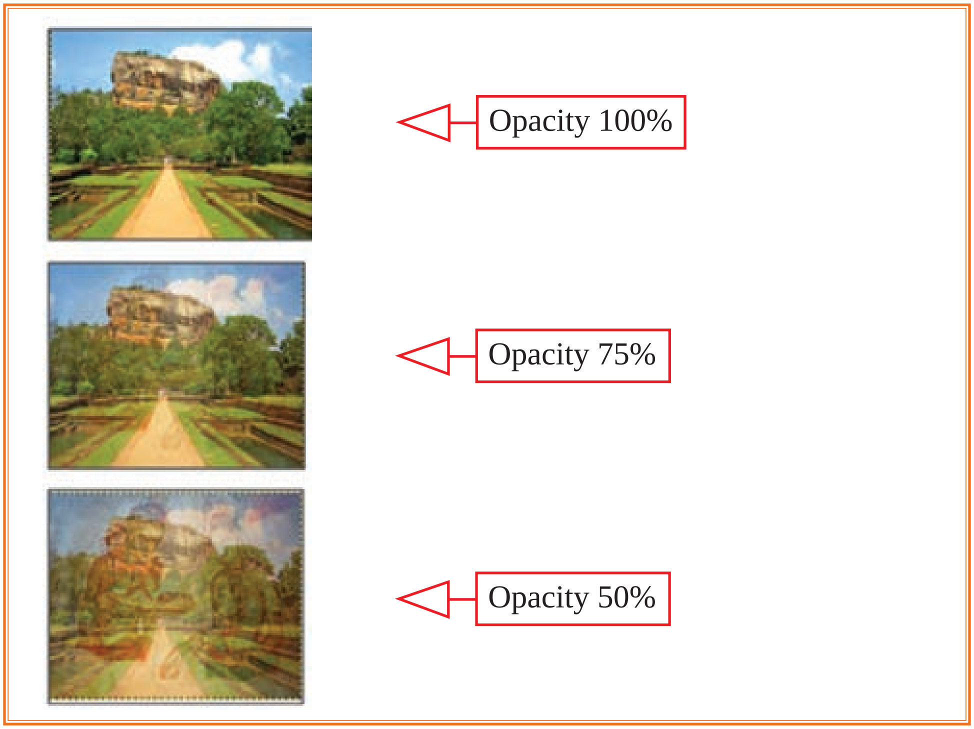
Layers resemble sheets of transparent paper. However, when objects are added one above the other, the layer beneath may not be shown.

- For, different pictures, different layers are to be created on layer window.
- For each image a separate layer must be used on the layer window.
- This prevents alterations done on one layer affecting another layer. (adding texts, adding colour, shapes, editing etc).
- Use the eye symbol to make the layer visible or invisible.
- Use the bottom line of layer window to make various alterations.

1. New
2. Group
3. Move
4. Duplicate layers
5. Anchor
6. Delete



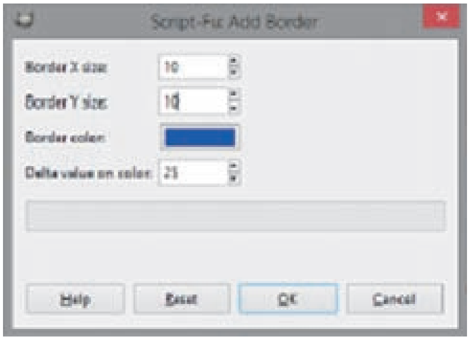
- Opacity - Can be seen high above the Layer window. By increasing or decreasing the opacity of a selected layer, the visibility of the layers below can be altered.



Step 12 - Once, editing and positioning are completed, it is necessary to merge all layer together into one layer. For this purpose, Right click on Layer window and click, 'Merge Visible Layers' → 'Expand as necessary' → 'Merge'

Step 13 - Use 'Crop' tool to remove unnecessary sections in graphics created.

Step 14 - To add a border to a graphic, Select:
'Filter' → 'Decor' → 'Add Border'.
Set Border X – 10, Border Y – 10, Border colour blue → 'OK'
Border X – 15, Border Y – 15, Border colour yellow → 'OK'
Borders need to be created twice as shown above.



Step 15 - Save graphic. Thereafter, Export it.

2. Creating graphics with texts



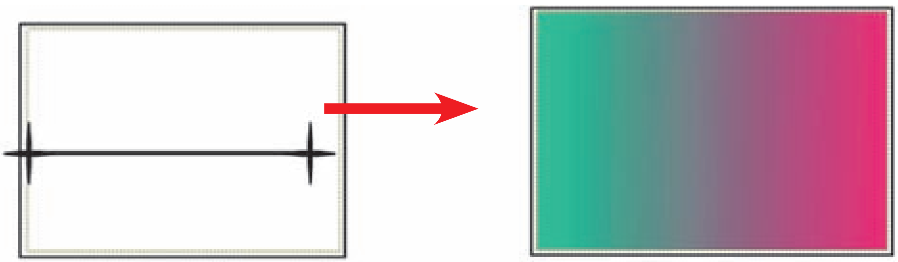
Step 1 - Open GIMP software

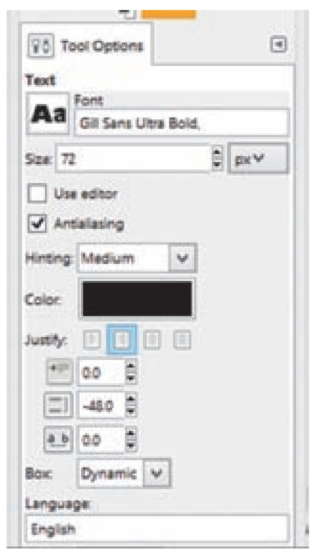
Step 2 - To open a new graphic window, click 'File' → 'New' In the dialogue box select 'Create a New Image', set width - 640, height - 400 px and click 'OK'.



Step 3 - For foreground and background colour, change HTML notation value 29c89c, e3216a to select the colours.
Next, select Gradient tool.

Step 4 - Click to draw a line on background window from left corner to right corner. The background gets coloured with selected colours.



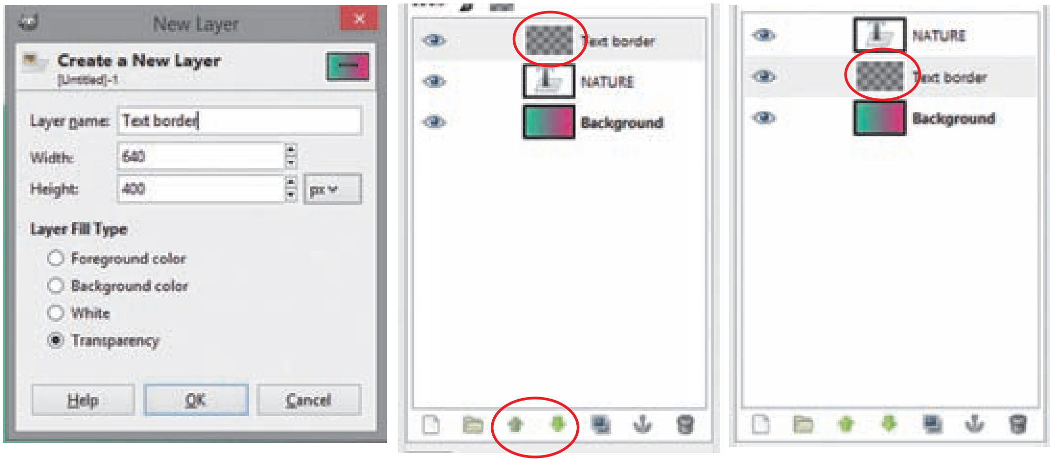


Step 5 - To add text:
Select 'Text' from Tool Options. Tool Option changes accordingly. Follow procedure given below to suit the text.

- Font type - Gill Sans Ultra Bold or a broad letter type
- Font size - 72
- Colour - Black

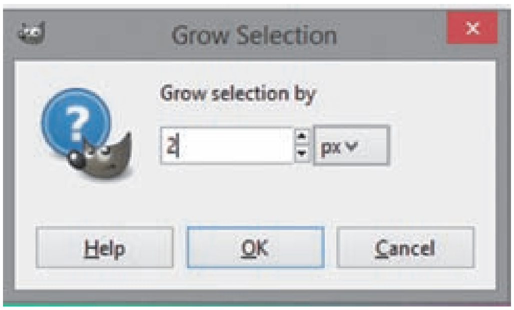
Click on window and type NATURE. Using 'Move' tool, drag text to the center.

Step 6 - To include a border around the text, select the layer which contains the text and add another layer below this. Name the new Layer, as 'Text Border'. Using arrows, shift 'Text Border' downwards from text Layer.



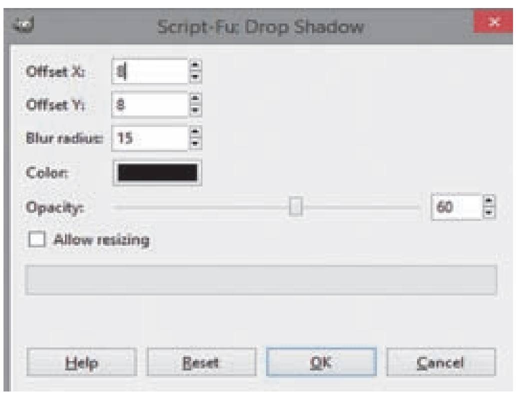
Step 7 - Select text Layer. right click and select 'Alpha to Selection'

Step 8 - To increase the selected area :
Select → Grow
Increase
'Grow Selection' to 2
pixels and click 'OK'.



Step 9 - Select Text Border Layer
Select white as Foreground colour and to fill colour, select Bucket fill and click on the text.
Next, 'Select → None'.

Step 10 - To Add Shadow to text
Select 'Text Border' layer
From the Menu, select:
'Filters' → 'Light and Shadow' → 'Drop Shadow'.
Set the values as shown in figure. Click 'OK'.



Step 11 - Once, it is placed it needs to merge all layers together.
Right click on Layer window and click:
'Merge Visible Layers' → 'Expand as necessary' → 'Merge'.

Step 12 - Add a border to the graphic as you learnt earlier. Save in the correct place. Export the graphic.

> Note: It is possible to use different colours and different patterns for the background of a graphic. Select a pattern. Click mouse on selection → Drag and drop on the background.
> Use different pictures and create few backgrounds.

Examples:





Activity

1. Create a graphic using several photographs you have captured on a special occasions or found on the computer.
2. Using other 'Filter' methods used in graphic designing, produce a better finish to the graphic you created.
3. Download images of places of special interest in Sri Lanka from the Internet. Create graphics using the images downloaded. Give suitable titles or introductions to them.
4. Create an invitation for digital printing.
5. Create a banner for a special event held in the school.

4.2 Two - dimensional animation

The previous lesson discussed several areas connected with the creation of digital graphics as related to digital creations and graphic design.

The main aim of animation is to give more depth to a static graphic and make it look real or authentic.

Creative animations are used in commercial publications, as a media to promote products, to develop computer games and creating cartoon films.

What is animation?

Animation is an optical illusion to show the movements of an object or objects. A series of frames of an object or objects are arranged in a sequential order and displayed continuously to create the animation. The speeds of the objects can be changed by changing the speed of frames.

Basics of animation

Types of Frames

Several frames are used to create an animation. They are: Key frame, Tween frame, frames, and Blank Key frames.

- **Key Frame:** A key frame is the main, specialised static frame in a series of frames to be used with the creation of an animation. The user decides on the key frame for the creation. In a complete motion, there can be many key frames in important positions.

  E.g. - The frames used at the beginning and at the end of motion are Key Frames.

- **Tween Frames:** Animation is created in the Tween Frame. The purpose of a tween frame is to create smooth motion between two frames. While the user creates the key frames, the software creates the tween frame. It is possible to create smooth motion of 24 frames per second (fps). In a motion consisting of 24 frames, the additional 22 frames are created as Tween frames.

  E.g. - There are two key frames; one at the beginning and the other at the end. In a motion of 24 frames, the rest of the 22 frames are created by the computer programme. Eventually, The user creates an animation with a smooth motion with little effort.

- **Frames:** When an adjoining frame is added to a frame with a content, the time period of the content in the animation can be increased.
- **Blank Keyframe:** In every instance when blank key frame is added, it provides a blank frame to include a content. However, when a creation is done in this, it is no longer a blank key frame.

Animation

Vectorian Giatto

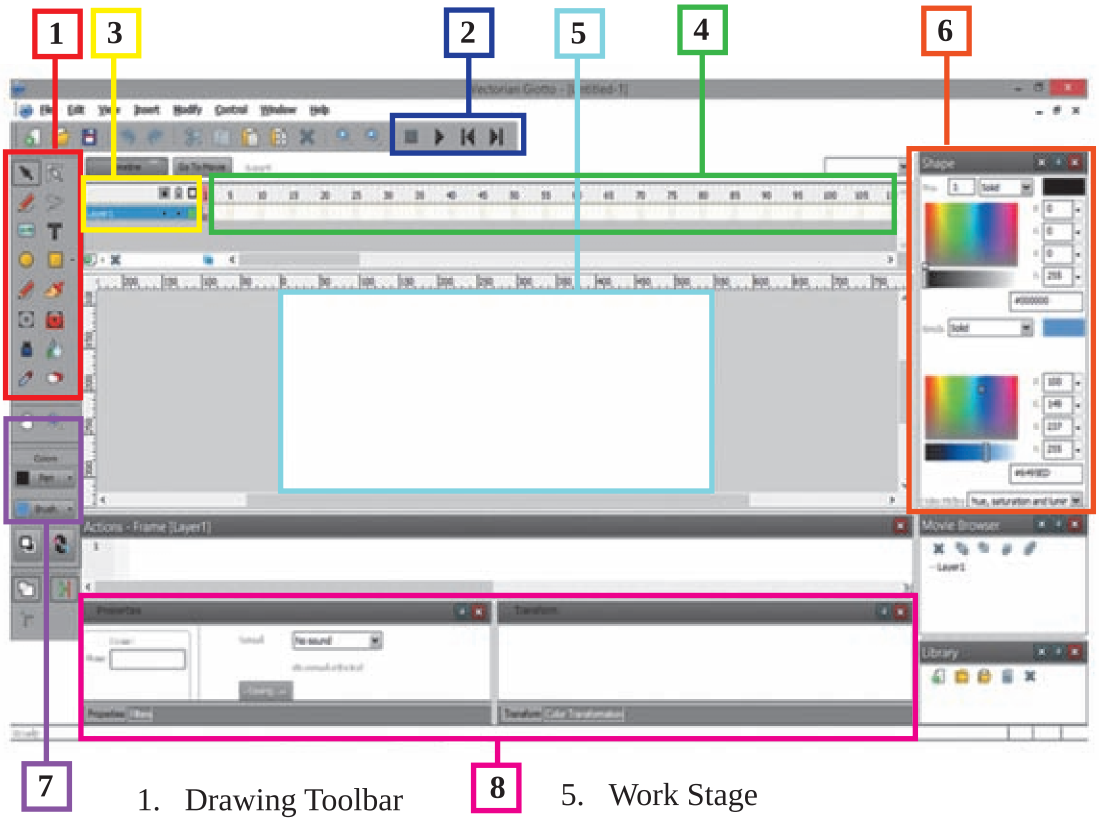
Vectorian Giatto is produced for animations. It is a free software and can be downloaded from the Internet. This software is easy to use and requires no coding unlike with some other software for animation.

The main purpose of this software is to embed motion for created images, while there are nearly 50 flash animation tools.

The specialty with Vectorian Giatto is in its ability to remain free from complex scripts and enable creation of simple animation including music.

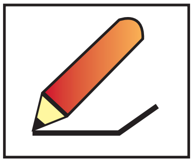
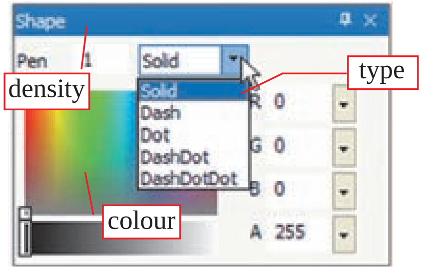
Vectorian Giatto software can be downloaded and installed in your computer from: http://vectorian.com/giatto

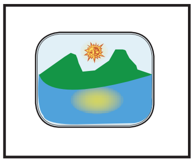
The Graphical User Interface of Vectorian Giatto

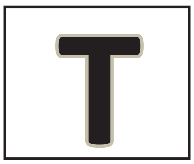


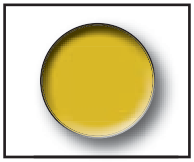
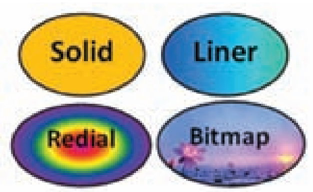
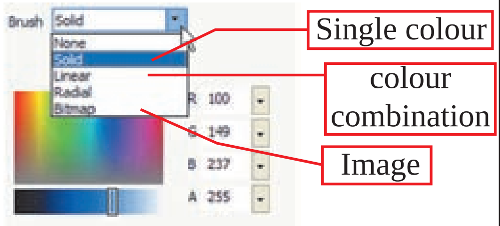
1. Drawing Toolbar
2. Build-in-player
3. Layers
4. Timeline
5. Work Stage
6. Geometrical Properties and Shapes
7. Colours
8. Properties Window

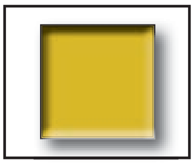
1. **Drawing Toolbar:** A basic need of animation is to create an object or a text on a work stage for motion or editing. The tools that can be used for this purpose. are as follows:

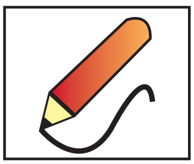
 Line tool (N)	Can be used to draw lines on the work stage. 1. Click on the tool. 2. In the column for the Shape, select type of line and colour, using the pen. Include the number for density. 3. By clicking the mouse, keep drawing on the work stage. Note: On completion of drawing lines, it is possible to change type, colour and density as required. 

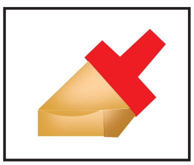
 Insert bitmap (M)	This is used to add a picture to the work stage. Image file formats that can be added to work stage are; Bitmap (bmp), JPEG (jpg), TIFF (tif), PNG (png), GIF (gif) and ICO (ico). 1. Click on tool. 2. Select and open the image from 'Open' dialogue box.

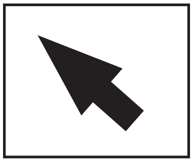
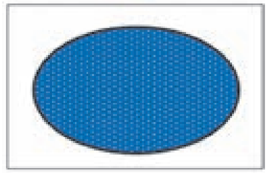
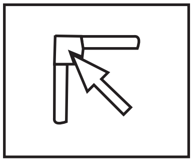
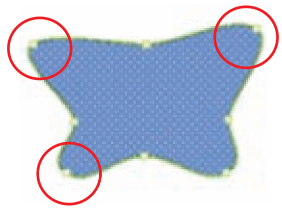
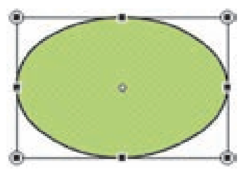
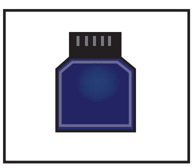
 Text tool (T)	This is used to add text to the work stage. 1. Click on the tool. 2. From the Properties window which is opened at the same time, select font type, size and alignment. Select colours from 'Brush' Click mouse on work stage and type.   Note; If ‘Properties’ window does not appear, Click 'Window → Object properties' Changes can be done after the completion of typing.

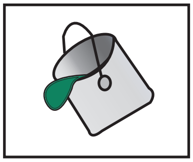
 Oval tool (O)	This is used to draw oval shapes on the work stage: 1. Select tool. 2. Select border type, colour and density from 'shape' bar. and select colour using ‘Brush’. 3. While clicking mouse, continue drawing on work stage.   In the colouring process: • One colour • Combination of colours or a picture can be used.

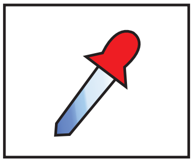
 Rectangle tool (R)	• This helps draw rectangular shapes on work stage. Follow steps used to draw oval shapes discussed earlier.

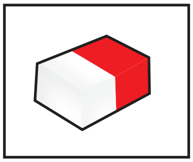
 Pencil tool (P)	• This can an be used on the work stage to draw free lines. 1. Select tool. 2. Follow steps that were used in drawing lines earlier.

 Brush tool (B)	This can be used to draw wider shapes on the work stage. 1. Select tool. Follow the steps described for drawing lines, using the pencil.

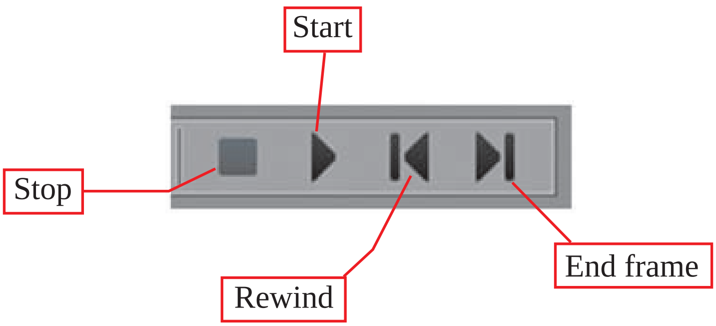
 Selection tool (V)	Selection tool is used to select or move around shapes, texts and pictures.  1. Select tool. 2. Place the arrow head on the object and click. 3. If the object gets covered in small white dots, the picture or object is selected.
 Sub selection tool (A)	This is used to change the appearance on the created shape.  1. Select tool. 2. Click on the shape to be changed. 3. Click on the marks around it, drag in or out to do the change.
 Lasso tool (L)	This helps to cut and remove shapes or pictures on work stage. 1. Select tool. 2. Click on the image and get the selection.
 Free transform tool (Q)	This is used to change dimension, rotate or change the shape of the object.  1. Select tool. 2. Click on object. 3. Click on tools around the object and do the changes.
 Ink bottle tool (S)	This is used to change the border around shapes drawn on the work stage. 1. Select tool. 2. Use 'Shape → Pen' to select area, colour and type. 3. Click on 'Object'.

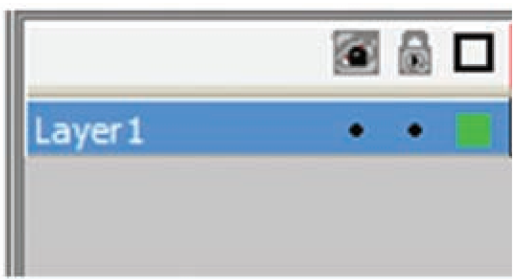
 Paint Bucket tool (K)	This is used to change colour on shapes drawn. 1. Select tool. 2. Use 'Shape' → 'Brush' to select a colour or a combination of colours

 Eyedropper tool (I)	This is used to select a colour combination on one object, to be used on another object elsewhere. 1. Select tool. 2. Click on object with a necessary colour. 3. Click on the object where there are no colours.

 Eraser tool (E)	This is used to erase only a section of a creation. However, this does not remove the entire shape.

2. **Built-in-player -** Built-in-player is used to play, stop, rewind or move to end with an animation created.

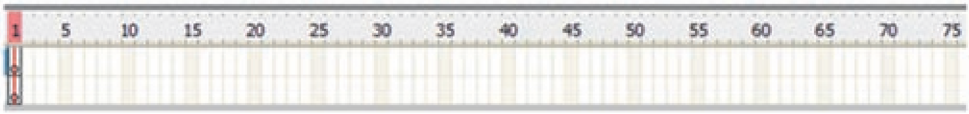




3. **Layers** - Layers are important in the creation of simple and complex animation. The use of different layers helps with the organization of different objects in animation. Layers are similar to a collection of transparent papers. Getting one object on to another can obstruct the lower

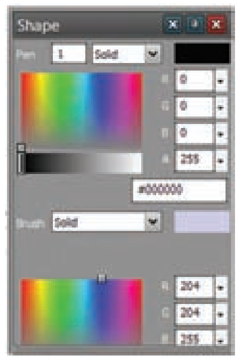
layer. Usually, when Giotto is opened, the first layer can be seen. It is named Layer 1. Right click on the layer frame can bring up another layer, remove one, make the layer visible or not, lock/unlock the layer and place it in the correct position.

4. **Timeline** - Timeline is an important feature in animation. Timeline sets time period for animation.

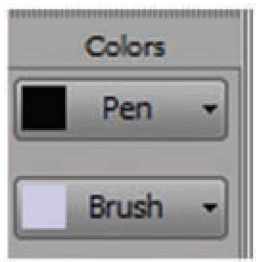


5. **Work stage** - Animations are created on the work stage.

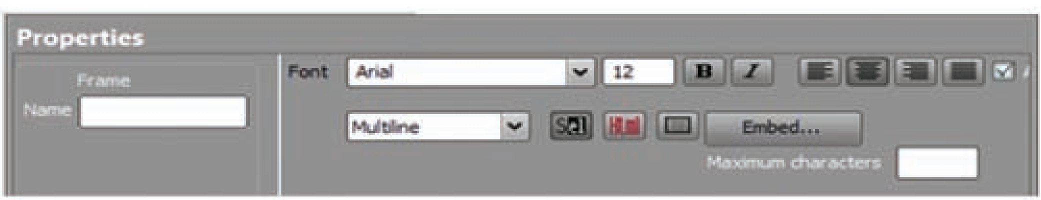
6. **Geometrical Properties and Shapes** - The geometric properties and shapes window is used in colouring the shapes. This window is also helpful with the selection of border type and adding border colour, combination of colours, drawing designs and inserting images.



7. **Colours** - Basic colours for the tools (Pencil, brush, ink, bucket, letters) are selected from this window. Colour for the border is from 'Pen' and fill colour from 'Brush' can be obtained.



8. **Properties Window** - In the selection of text tool, the properties window that changes accordingly can be used to select font size, font type, alignment etc.



Basics of animation

Open a new window to create an animation	File → New Movie
Saving an animation	• Click 'File → Save' • Type a name in 'Save Image' dialogue box • Select a location to save from 'Places' • Click 'save'

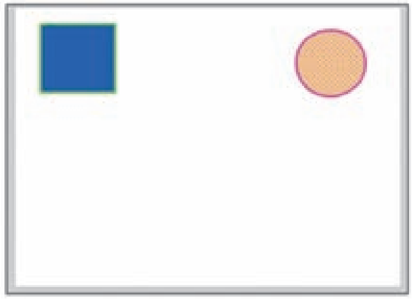
A file created by Giotto software is saved in the .vgd file format. The file can be saved to be used in web designing as well. This is called 'Export Flash Movie' and saved in .swf file format.

Export saved animation files to other file formats	To save as .swf file formats; Select 'File' → 'Export Flash Movie'. • Select the location for saving, give file a name and click 'Save'. • Thereafter the 'Export Settings' dialogue box opens. Select 'Compress movie' and click 'OK'.
Open a saved animation	• Click 'File' → 'Open' and open it from the saved location. To open the file as an animation, • Open the saved location. • Right click on the file. • Select the web browser you use. • It can be seen that the animation plays in the browser

Creating a simple animation using Vectorian Giatto

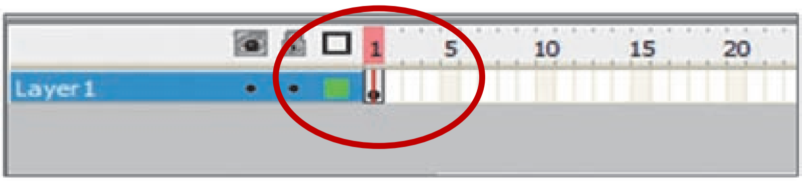
Step 1 - Open Giotto software.

Step 2 - On top of the work stage, draw two shapes - a square and an oval, as shown in the illustration.

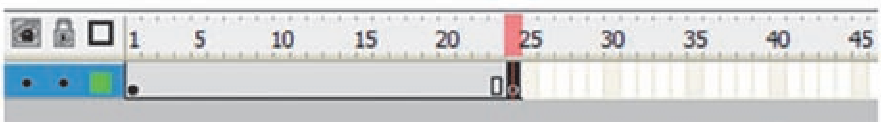


Step 3 - Using the tools to select these shapes, draw border and fill colours using the Pen and Brush.

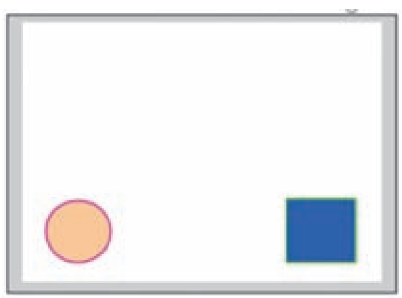
Step 4 - Observe that this activity is shown in the first frame in Timeline. This is the first basic key frame.



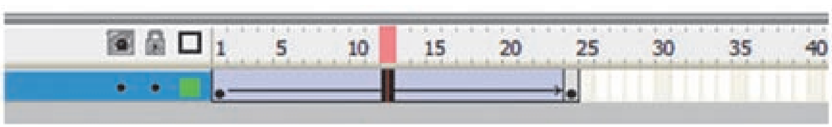
Step 5 - Right click on frame 24 in Timeline and select 'Insert Key frame'. Frames 1 to 24 can be seen as follows;



Using Selection tool, drag the square the oval drawings to the bottom created on the work stage.



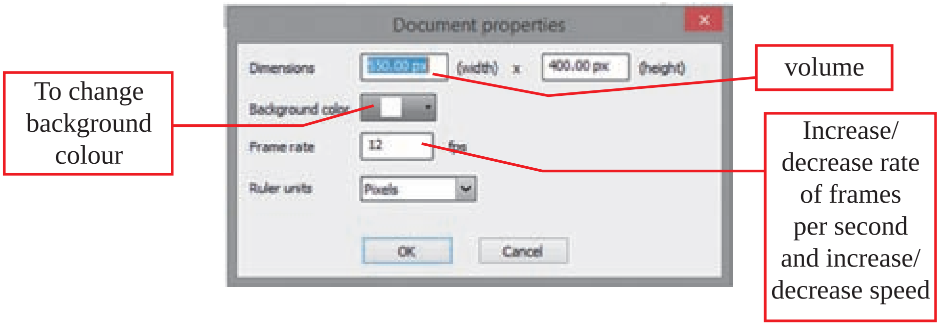
Step 6 - Right click on any frame in Timeline, 1 – 24. From the menu that comes up, select 'Create Motion Tween'. The Timeline is seen as follows.



Step 7 - Use Built-in Player to play the animation.

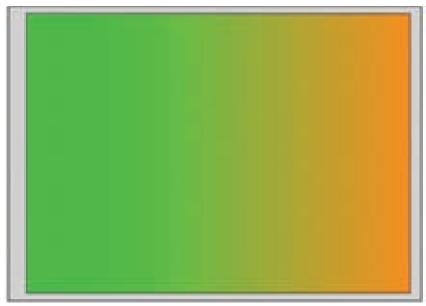
If it is necessary to increase or decrease the speed in an animation or to change the background colour or dimensions.

Click 'Modify' → 'Document'. From the dialogue box that opens, select 'Document properties' to do necessary changes. Click 'OK'.



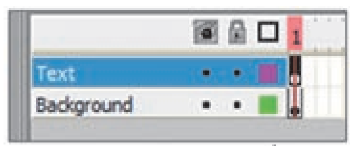
Creating animation with captions

Step 1 - Open Giatto software.



Step 2 - Draw a rectangle on work stage as shown.

Step 3 - Select 'Brush' → 'Linear' to arrange colours and fill colour using 'Colour basket'.



Step 4 - Double click on Layer I. Label it as 'Background'.

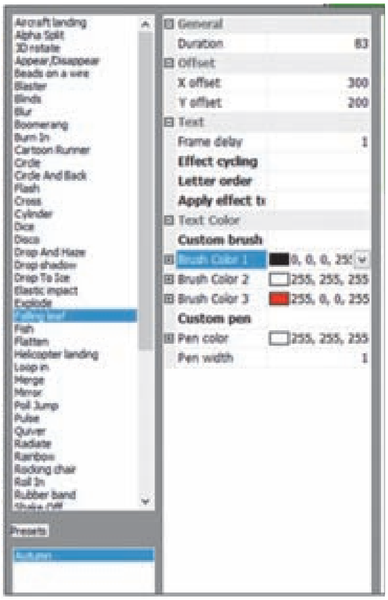
Step 5 - Right click on layer and select '+ Layer'



Step 6 - Label this layer as 'Text'

Step 7 - Select 'Text' layer. Using text tool, type 'Beautiful Sri Lanka' on work stage.

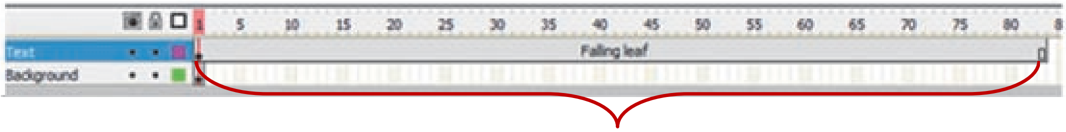
Step 8 - Select text and using Properties window, edit caption.
(Font type – Curlz MT, font size – 35)
Centre the text as shown.



Step 9 - Right click on the text and select. 'Effect' → 'Add'.

Step 10 - 'Effect' window shows many effects that can be added to the text
Select 'Falling Leaf'. Click 'OK'.

Observe the changes in the 'Text' frame accordingly.



Effects have brought about changes to the Text frame. The background time frame too has to be edited accordingly.

Step 11 - Select 'Background time frame'. Right click on 83 frame (The end of the text frame) and select 'Insert' key frame.

Step 12 - Save the animations, export and open.

Activity

Create an animation by adding a motion text using an image you have created.

4.3 Audio Content

In the last lesson, we learnt about creating still graphics and animations for effective communication. To make such creations more meaningful and attractive, voice or sound can be added. Files that are created using recorded sounds or voices are known as audio content. These files can be edited as necessary using computer software. Some such software are as follows:

- Audacity
- Power Sound Editor
- Mp3DirectCut
- Music Editor Free
- Wavosaur
- Ardour
- WavePad Sound Editor
- Sound Engine

Audio editing

Audacity

Audacity is a free software that can be installed in Windows, Mac and Linux operating systems. Audacity can be used for both editing and recording purposes. It consists of multi layers. In installing the software, the user can select the language in the interface to suit user's choice.

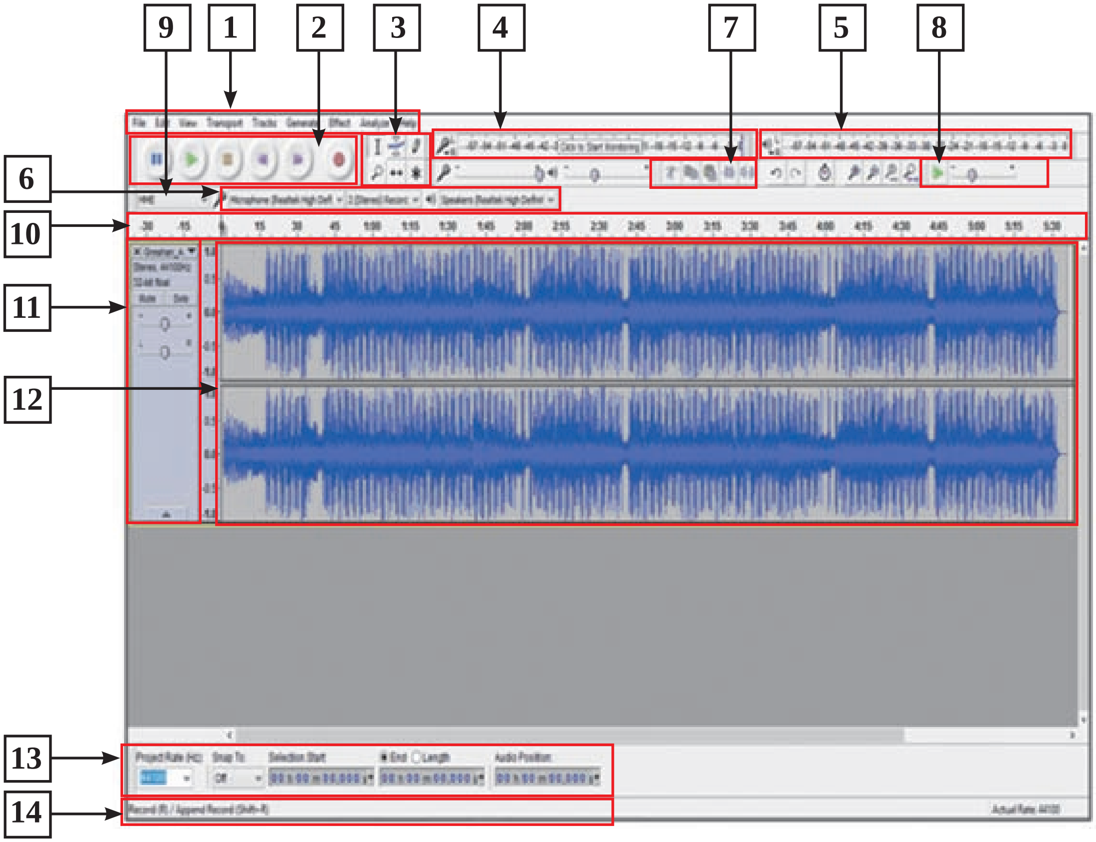
Audacity has functions for;

- Recording live audio proceedings
- Recording music being played in the computer
- Inserting sound effects on recorded digital graphics write on CDs/DVDs content.
- Editing file formats such as WAV, AIFF, FLAC, MP2, MP3 or Ogg Vorbis
- Copying sound, trimming, mixing, or joining together for editing purposes
- Changing speed and pitch in recordings

Audacity can be downloaded from the following URL;

http://audacity.sourceforge.net/

Audacity Interface



1. Menu Bar
2. Transport Toolbar
3. Tools Toolbar
4. Recording Meter Toolbar
5. Playback Meter Toolbar
6. Mixer Toolbar
7. Edit Toolbar
8. Transcription Toolbar
9. Device Toolbar
10. Timeline
11. Track Control Panel
12. Audio Track
13. Selection Toolbar
14. Status Bar

Basics of using software for sound effects

Open a new window for creating audio content.	File → New
Saving a created audio content.	• File → Save • Select location for saving, type a file name and click 'Save'.

The file format used to save Audacity file is .aup. File saved in this format can be edited.
It is also possible to save such a file so as to use in web designing. This is known as audio exporting. There are several file formats where the animation can be saved. Some of them are: WAV, AIFF, FLAC, MP2, MP3.

Export Audio	• Select 'File' → 'Export Audio'. • Select the location for saving. Give it a suitable name. • Select required file format from of 'Save as type'. Click Save. (Audio content compresses at this stage) • Dialogue box 'Edit Metadata' opens. Using it, provide details such as audio mixing (name, year, title etc) and click Ok.

Audio Recording with Audacity

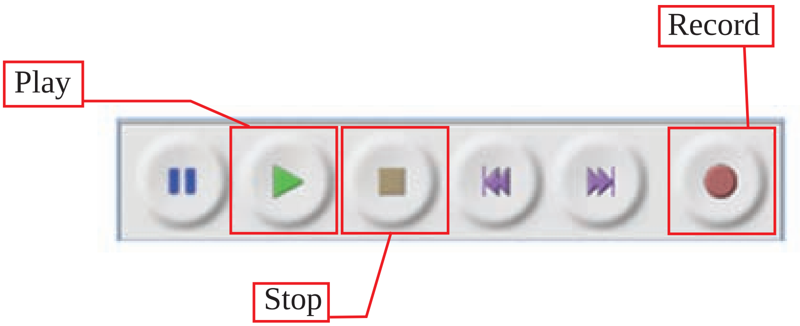
Step 1 - Click 'File' → 'New'.

Step 2 - Click 'Record' on Transport Toolbar.

Step 3 - Using the microphone built into the computer, record the required audio content.

Step 4 - Click 'Stop' on Transport Toolbar to end recording.

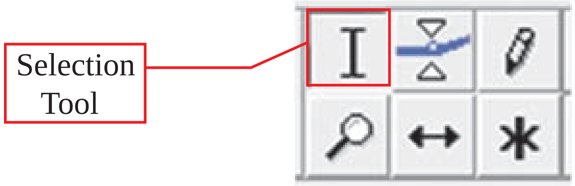
Step 5 - Click Play and listen to the recording done.



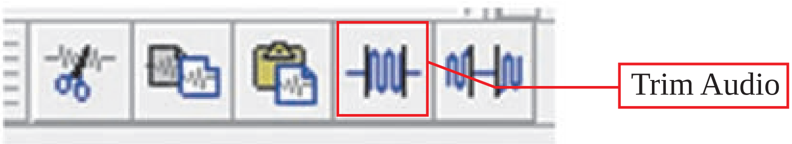
Editing recorded sound track to remove unnecessary sections

Step 1 - Open created file saved using -.aup (Audacity Project) file format.

Step 2 - Using Selection tool on Transport Toolbar select the necessary sections in the audio content.



Step 3 - Click 'Trim Audio' on Edit Toolbar. This helps remove unnecessary sections.



Step 4 - On completion of editing, Save edited file.

4.4 Creating a video clip

A video created using a series of visuals is called a video clip. For this, a recorded video, or still pictures and audio content can be used. Software can be used to create and edit video content.

Some software that are used to create video clips and edit as follows;

- Photo Bucket
- YouTube Remixer
- Movie Masher
- One True Media
- Motion Box
- Stash Space
- Windows Movie Maker
- AVI Edit
- Super DVD Video Editor

Use of video editing software to create video clip

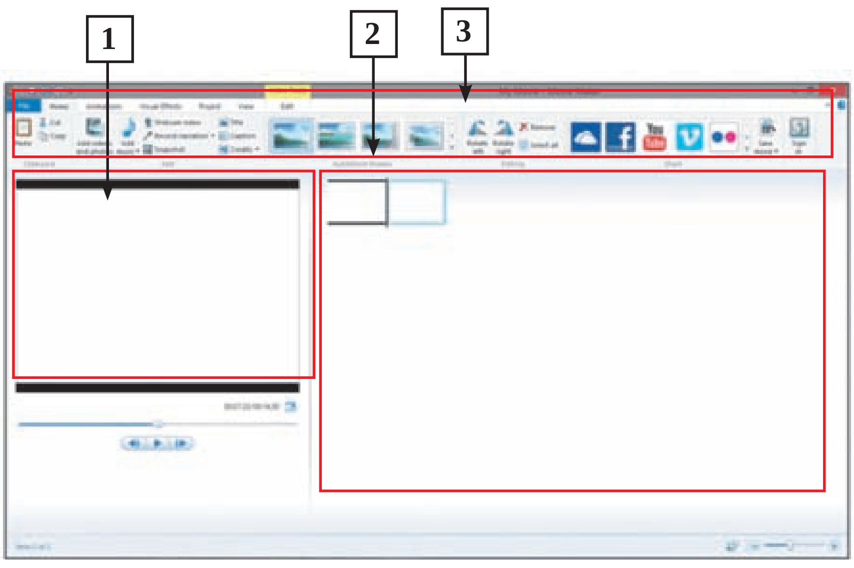
Windows Movie Maker

Windows Movie Maker is a free software provided by the Microsoft co-operation. This software can be used to create and edit video clips.

Download and install Windows Movie Maker software from the URL given below.

http://www.windows-movie-maker.org/

Windows Movie Maker – Interface



1. Preview/Player pane
2. Timeline stage
3. Editing function panel

1. **Preview/Player pane**

This is used to view a video and image frames expected to be used in a video clip and to watch a created video clip before saving it.

2. **Timeline stage**

The video clips to be created, the image frames and the audio clips are arranged on Timeline stage. Unlike on a time frame, the images and image frames are displayed very clearly.

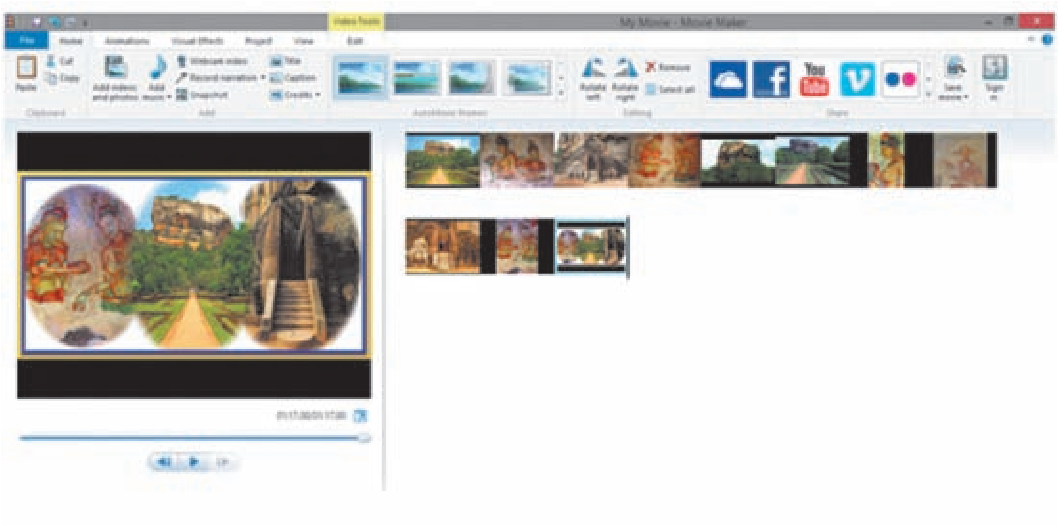
3. **Editing function panel**

The tools in the editing function panel are important for editing video clips that are created. These tools can be used to edit video content, add visual effects and edit audio content.

Making a video clip with Windows Movie Maker

Step 1 - Open Windows Movie Maker software.

Step 2 - Using 'Home' → 'Add Videos' & Photos' open video clips for the creation.
The screen to appear will look like as follows:



Apply Transition

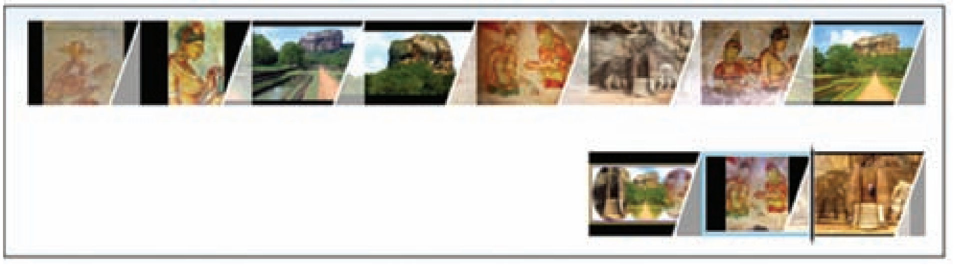
Transition is used to show the relationship between two image frames and the manner in which the frames appear.

Step 1 - Open menu ‘Animations’.

Step 2 - Click on first frame.

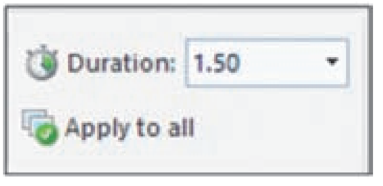
Step 3 - Take the mouse along each transition. The selected image is displayed in various forms. Then, click on the suitable transition.

4. Apply suitable transitions to other images on the Timeline stage. After applying transitions, Timeline stage is shown as follows.



5. Using the Preview/Player pane, play the creation. Edit as necessary.

6. To arrange the time period to display an image frame, use 'Animations' → 'Duration'. Select 'Apply to all' to enable use of same effects for all image frames.



7. To move image frames:
   i) Select the image frame.
   ii) Use Mouse over each movement shown in 'Pan and Zoom'. Click on suitable motion.

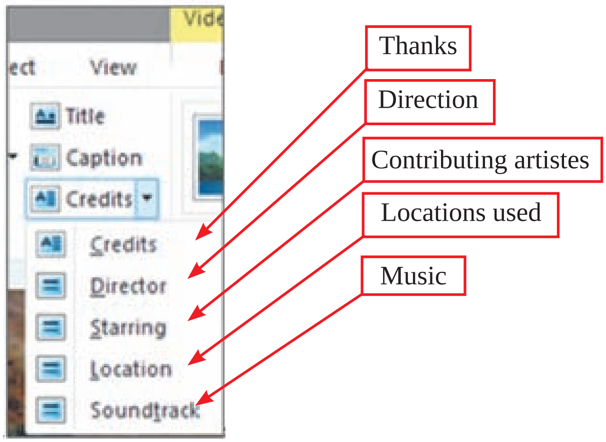
8. To add a topic to the creation:
   i) Select first frame.
   ii) Select 'Home' → 'Title'.
   iii) Type a suitable topic.
   iv) Open Format menu. Add Effects to suit topic.

9. Captions can be added to each image frame. For this purpose:

   i) Select image frame.
   ii) Select 'Home → Caption' and type a suitable caption
   iii) Format as shown earlier.

10. At the beginning or at the end of the video content, the direction, artists, music, venue etc. can be introduced. Separate frames can be added for this.

   i) Select the necessary introduction from 'Home → Credits'.
   ii) Type in necessary information.



11. The video content can be more effective by adding an audio content.

   i) Select first frame
   ii) Select 'Home → Add music'

12. Select and open an audio file prepared beforehand. At the end, the timeline stage is shown as follows:



13. Play the video content. Edit as necessary.

Saving an animation

'File' → 'Save Project'

Select a location for saving. Give file a suitable name. Click 'Save' to save the file.

A video clip that is created using Windows Movie Maker is saved .Wlmp (Movie Maker Projects) format. Files saved in this format can be edited.
Video clip can be saved so that it can be viewed through web browser and social media (Facebook, You Tube, Flicker)

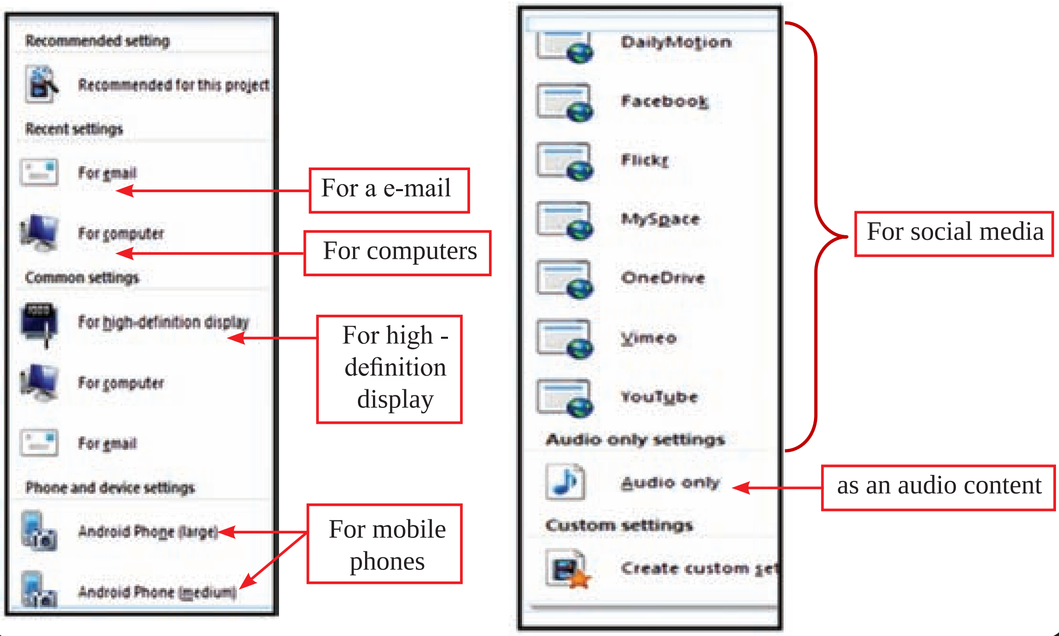
Saving and distribution of video content as a video clip

Method of saving a video content as a video clip to be watched on a computer, television, mobile phone or to open in social medias as follows;

Step 1 - Select the medium to save by 'File' → 'Save Movie'

Step 2 - Select location to save, give the file a name and click 'Save'.

Various media of file saving



Activity

1. Create a few still graphics using photographs of special places of Internet in Sri Lanka using the lesson learnt in this chapter.
2. Create a few two dimensional animations by using the still graphic in the background.
3. Include an audio content to suit the created graphics and animation.
4. Using the creations above, prepare a video clip about the places in Sri Lanka.
5. Compare and contrast lossy and lossyless graphic compression.
6. Compare and contrast raster graphic and vector graphics.

Summary

- Images or graphics created using graphic software are known as digital graphics.
- Basic elements of a digital graphic are pixel, resolution, size and colour.
- Pixel is the basic element of a digital graphic. Digital graphics are made up of thousands of pixels.
- Pixel is composed of bits. Single colour pixel is made up of 8 bits while a colour pixel is made up of 24 (8×3) bits.
- The unit to measure the physical dimension of a digital graphic is pixel and physical dimension is known as image resolution.
- A high resolution digital graphic has higher quality.
- There are two types of colour models;
  - ➢ RGB model (Red, Green and Blue)
  - ➢ CMYK Model (Cyan, Magenta, Yellow and Black)
- Single colour- Primary colours
- Two colours - Secondary colours
- Three colours - Triplet colours
- There are 256 (1 - 256) colours
- RGB Triplet is formed from 000,000,000 to 255, 255, 255
- For example 'RGB Triplet' = RGB (245, 102, 36) = RGB (F5, 66, 24)

- There are two forms for graphic compression;
  - Lossy
  - Lossless
- There are two types of graphics:
  - Raster Graphic
  - Vector Graphic.

5 Web Designing Using Multimedia

After studying this chapter, you will understand the following:

- Content of a website
- Fundementals of Web designing
- Publishing a website
- Maintaining a website

5.1 Structuring information for web designing

There are several aspects that attention should be paid when designing a web site. Imagine you are member of a group of students assigned to design a website. You should consider factors such as the purpose, the user, and how to maintain the website etc.

5.1.1 Web applications

There are several web applications. Examples are as follows.

i) Information Communication

There are websites designed to communicate various information such as educational and health for the users.

Example - www.nie.lk, www.surgery.lk, www.webopedia.org

ii) e Commerce

This includes websites which sell goods and services through the Internet.

Example - www.farlin.lk, www.lego.lk, www.amazon.com

iii) Entertainment

There are websites for entertainment which provides download materials such as songs, films and teledramas, games, broadcasts and telecasts

Example - www.islandcricket.lk, www.netflix.com, www.youtube.com

iv) Advertising

These websites provides information on goods and services provided by various organizations.

Example - www.onclickads.net, www.adcash.com, www.myadvertisingpays.com

v) News

These websites publish news using multimedia.

Example - www.itnnews.lk, www.rupavahini.lk, www.bbc.co.uk

vi) Social Media

These websites provide facilities to develop social networking among various groups depending on their educational background, occupation, tastes or other factors.

Example - www.facebook.com, www.linkedin.com, www.twitter.com

vii) Search engine

These websites provide facilities to find information from the World Wide Web using a word or a phrase as the key.

Example - www.google.com, www.msn.com, www.bing.com

viii) Personal

These are often used by popular persons such as writers and politicians to disseminate their information.

Example - www.president.gov.lk, www.arthurcclarke.net, www.nelsonmandela.org

5.1.2 Web user groups

Those who access a website and use are known as the users of the website. For instance, www.google.com is used by many people around the world and they are the users of the Google website.

In designing a website, it is understood that the user is important. The following are useful in understanding them:

1. Language and culture
2. Age
3. Educational level
4. Gender
5. Preferences

When designing a new website, various methods can be used to understand the target user group.

For instance,

1. conducting a study on target users.
2. Analyzing similar websites.

For example, let us consider, the home page of the official Website of Sri Lanka (Figure 5.1) and website of Telecommunications Regulatory Commission of Sri Lanka. (Figure 5.2). You can observe that there are facilities to access them in all the three languages.

The website in Figure 5.2 provides the facilities to change the font size according to the user preference and to access social networks.



Figure 5.1 - Home Page of www.srilanka.lk

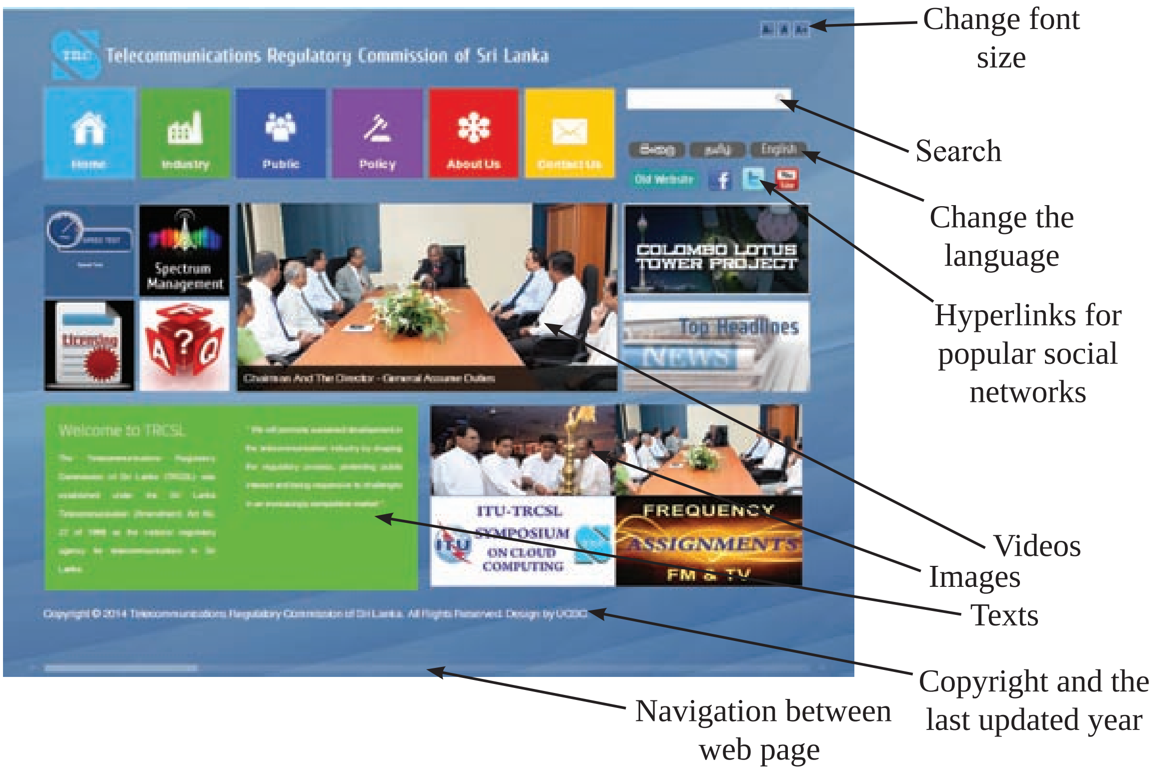


Figure 5.2 - Home page of www.trc.gov.lk

5.1.3 Web content

All the audio-visual information and services a user comes across in a website are called its web content. The web content of the new website should be selected considering the need/s of the user identified in the user group analysis. Web content should include the information to be communicated to the user as well as all the services to be provided to the user.

Various types of information and services can be found in the web content of websites. Following are some of them:

- Texts : information given in short 
- Images : photos taken from a camera, clip arts, drawings, scanned
- Sound : songs, voice clips 
- Video : video clips
- Animations
- Copyrights and information about updates

- Hyperlinks to other documents, pictures, audio-visual files, and social networks 
- Advertisements
- Search facilities
- Facilities to download certain software required to use the website.

As an example of identifying web content, examine the website of Telecommunications Regulatory Commission (www.trc.gov.lk) given in Figure 5.2.

5.1.4 Content Management

Systematic organization of the selected content of a website is known as content management. The main objective of this is to provide facilities to the users to use the website more effectively. Given below are some features of a well organized website.

- Easy to use
- Can find the information user needs fast
- Attracts users
- Easy to update
- Has room to add new features later

If the amount of information selected for the web content of the website is small, organizing web content is easy. However, if it contains a large amount of various types of audio-visual information, various methods are used organizing web content of such websites. Following are some examples;

1. Classification based on site map

By developing a site map to classify the web content, one can get a clear picture about the web pages need to be created in the website and the hyperlinks (link among pages) need to be created among these. For instance, in the site map shown in Figure 5.3 - website of a school, the number of web pages need to be created is indicated in square structures and the hyperlinks need to be created for interlinks among those pages are indicated in lines.

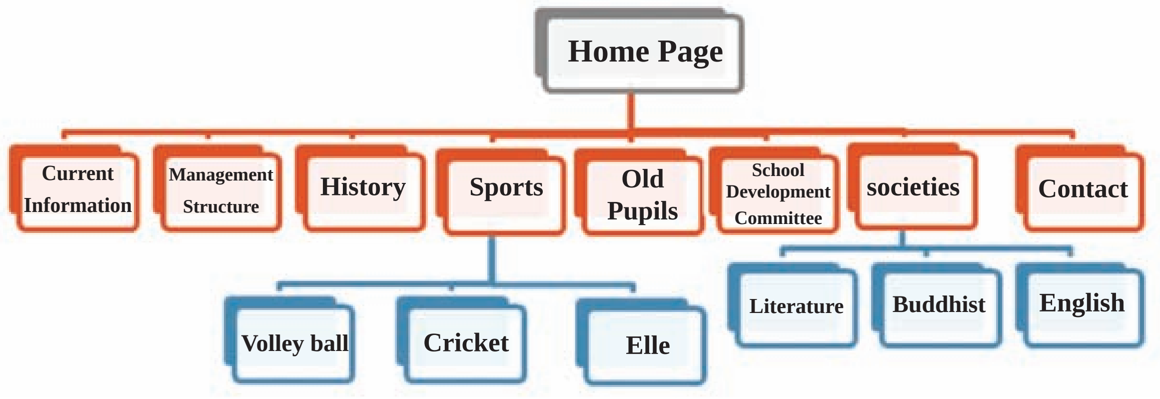


Figure 5.3 - Site map of website of a school

2. Display a summary of the entire content of the website in the home page

To manage the space in the home page;

- Use of main menu and sub menu (Figure 5.4)
- Use of hyperlink (Figure 5.5)

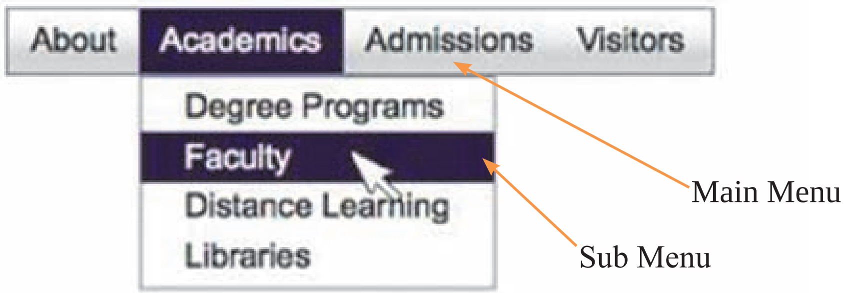


Figure 5.4 - Main menu and Sub Menu

3. Present information in brief

The attention of the user may not be drawn to some information, when a large amount of information is included in a single web page. Therefore, the content of a single web page should be limited.

4. Use of numbered lists, bulleted lists and indentation

This prevents the user getting exhausted by reading long text paragraphs.

5. Providing the facility for the user to navigate the website easily



Figure 5.5 - Easy navigation using hyperlinks (www.laksala.gov.lk)

6. Updating

Web site should be easy to update by the person maintaining the site. The accuracy of information is assured when the copyrights and the updated time periods are included clearly in each page.

5.1.5 Structure and layout

Structure and layout are the features such as backgrounds, tables, frames, font types, font sizes, font shapes. Some of them are as follows;

1. Maintaining the identity of the website in each page

This means preserving the identity of the web pages of a single website by keeping uniformity between backgrounds, font types, font sizes, font shapes etc.

2. Highlighting important information

For this, methods such as changing the font types and font sizes or different colours in the related information can be adopted.

3. Ability to access the website from any computer

Various users use different types of personal computers, various devices such as mobile phones to browse websites. Different sizes of screens are used as shown in Figure 5.6. Since the screen resolutions of these devices are different, some web pages are displayed in different ways on different screens. The website should be constructed in order to adjust the size of the webpage to that of the screen automatically.



Figure 5.6 - Various sizes of screens

Activity

Examine the websites given below with your teacher and discuss the strengths and weaknesses in their design.

www.srilanka.lk	www.schoolnet.lk
www.doenets.lk	www.bbc.co.uk/education

5.1.6 Selecting media resources

When selecting any type of media resource for a website such as various texts, pictures, sounds, videos and animations, several factors should be considered. The following are some such things to be considered;

1. Size

There is a very close connection between the size of media resources accommodated to a certain web page and the time taken to download that web page. If the size of these is high, more time is spent to opening that web page as more data should be downloaded from the web server to the users' computer (client computer). Since the users have to stay for a long time to use the web page, there may be a possibility for them to leave the site. Therefore, various methods are followed depending on to the media type. Following are some examples;

- **Graphics**
    - Reducing the amount of pixels by removing unnecessary sections using Crop/Trim in graphics software
    - graphic compression
- **Video files**
    - Reducing frame size
    - Reducing resolution
    - Adjusting frame rate
    - Removing unnecessary frames and sound
- **Audio files**
    - Reducing the bit rate
    - reducing the sample rate
    - reducing number of channels
    - removing or reducing unnecessary sound

2. Use of media resources adhering copyrights

If you use media resources created by another person in your website, it is your responsibility to obtain necessary permission from the owner. If not, it is unethical and may lead to legal issues as well.

However, as per the fair use of principles, it is possible to use media resources without permission for activities such as news reporting, academic purposes and critic.

Activity

Develop a plan to school website related to sub topics 5.1.1 to 5.1.6 mentioned above.

5.1.7 Use of Basic HTML

<u>H</u>yper **<u>T</u>**ext **<u>M</u>**arkup **<u>L</u>**anguage, which is known as the acronym HTML, is the language used for documents in the World Wide Web. An HTML document which can be displayed through a web browser is called a web page. Unlike the computer programming languages you learnt earlier such as Pascal, the codes of HTML language shows the web browser how the web page content should be displayed on the computer screen. Hence, HTML is not a computer language but a Markup Language.

Now let us design some simple web pages using HTML.

Activity No 01

Step 1 - As shown in Figure 5.7
Start → All Programs → Accessories → Notepad
Notepad is a simple software used in the Windows operating system.

Step 2 - Write statements on the Notepad as shown in Figure 5.8.

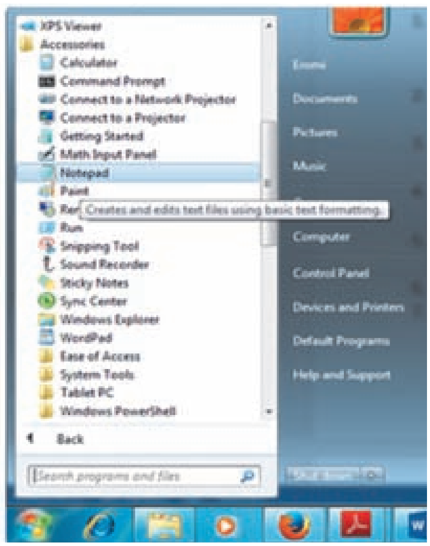


Figure 5.7 - Open Notepad

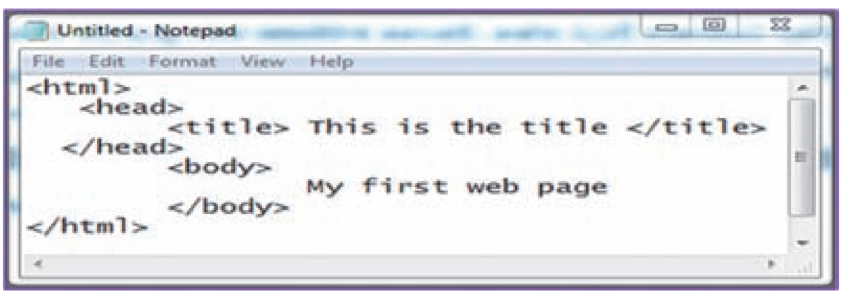


Figure 5.8 - HTML statements written in Notepad

Step 3 - As shown in Figure 5.9, type the file name of that notepad page as myfirst.html and select the file type as All Files. Then save it in a suitable folder.

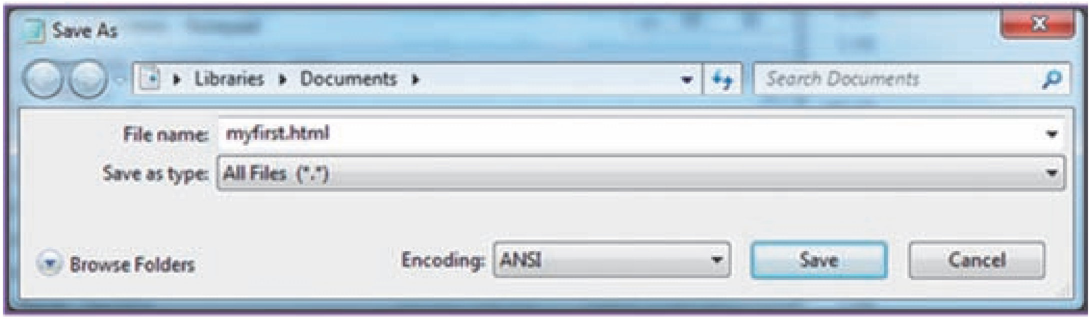


Figure 5.9 -The dialogue box appear in saving the Notepad page

Step 4 - Open the file myfirst.html. Your first web page will be displayed as shown in Figure 5.10.

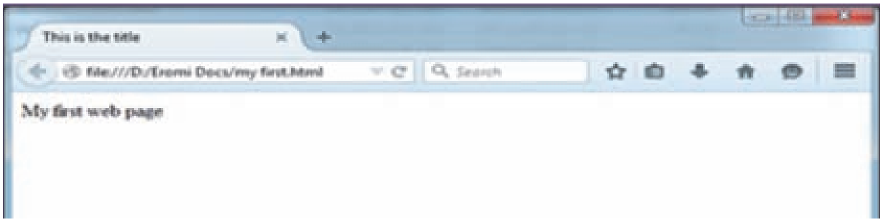


Figure 5.10 - An HTML file which is open

Step 5 - Instead of the phrases written on the notepad page in the second step above "This is the title" and "My first web page", write different phrases and create more web pages.

Step 6 - Instead of using a word processing software like notepad, software which are called HTML editors can be used to write HTML code. Following are some software with the web addresses to download.

1. CoffeeCup (www.coffeecup.com/html-editor)
2. Seamonkey Composer (www.seamonkey-project.org)
3. Eclipse (https://marketplace.eclipse.org/content/html-editor-wtp)

Install any one of the above software in your computer.

Step 7 - Open the web designing tool in your computer. Given in Figure 5.11 is how the HTML editor named CoffeeCup is opened after giving the command File → New HTML document.

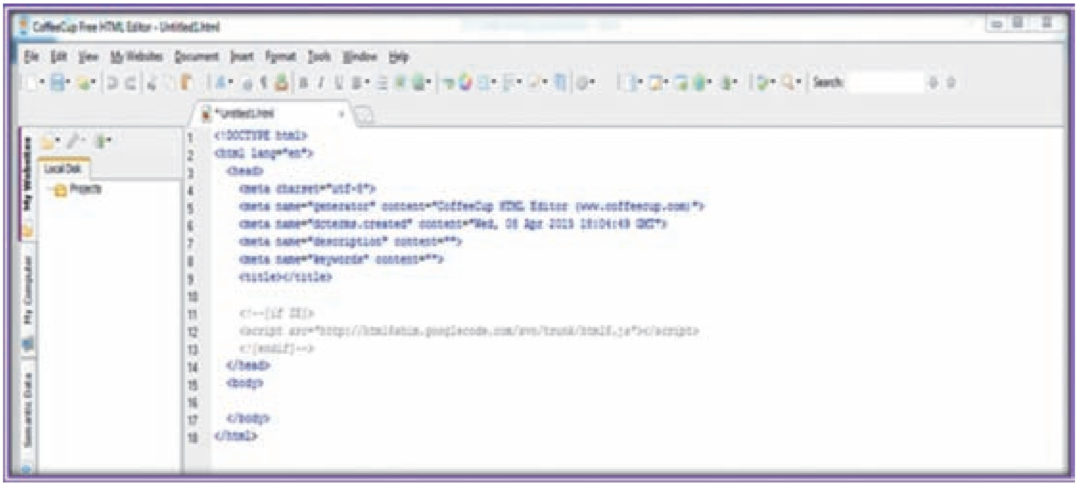


Figure 5.11 - Display of HTML editor in Coffeecup

You can see that a substantial number of phrases you wrote in step 02 on notepad page are automatically written here. It makes your task easier.

Now you can insert the items in the proper places in your web page. Figure 5.12 shows how the phrases “This is the title” and “My first web page” you inserted in the first web page.

Save this in your folder as coffeecup.html using the command File → Save As.

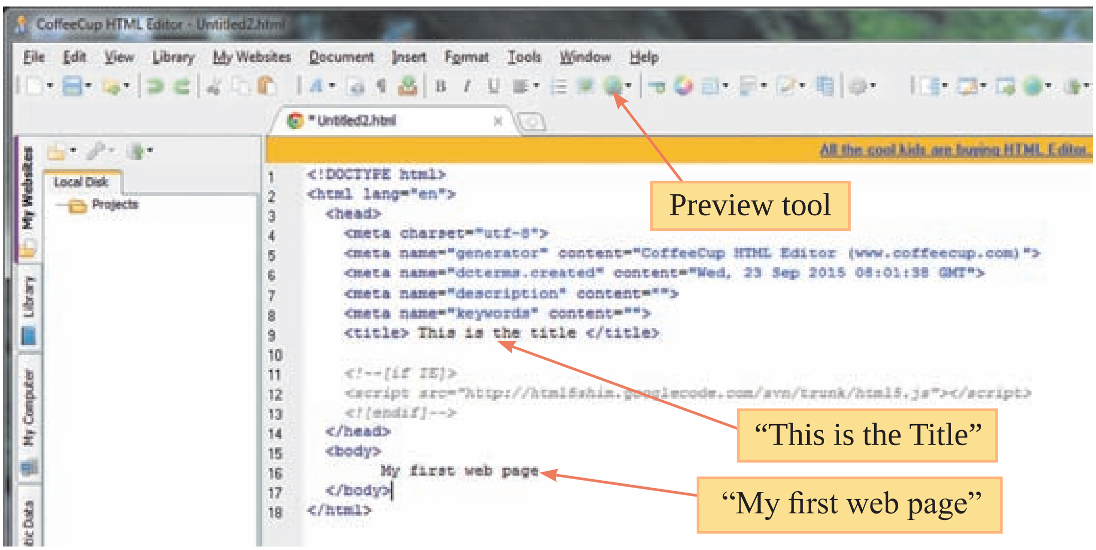


Figure 5.12 - Insert elements in CoffeeCupHTML editor

Step 8 - Now check the web page using preview tool. Design more web pages by inserting more new phrases.

Observation



So far you have written HTML documents which include phrases of HTML language or HTML codes using notepad and other tools.

What you use in angular brackets like <html>, <head>, <title> are types of HTML tags, which is a main feature of HTML. These tags indicate to the web browser how the web page content should be displayed to the user. This means the structure and layout you have selected are entered in the web page using HTML tags.

5.1.8 The Basic Structure of an HTML Document

Figure 5.13 given shows some essential tags in the basic structure of an HTML document. Mostly, a tag consists of an opening tag and a closing tag. However, you will later come across some tags later which consist of an opening tag only.

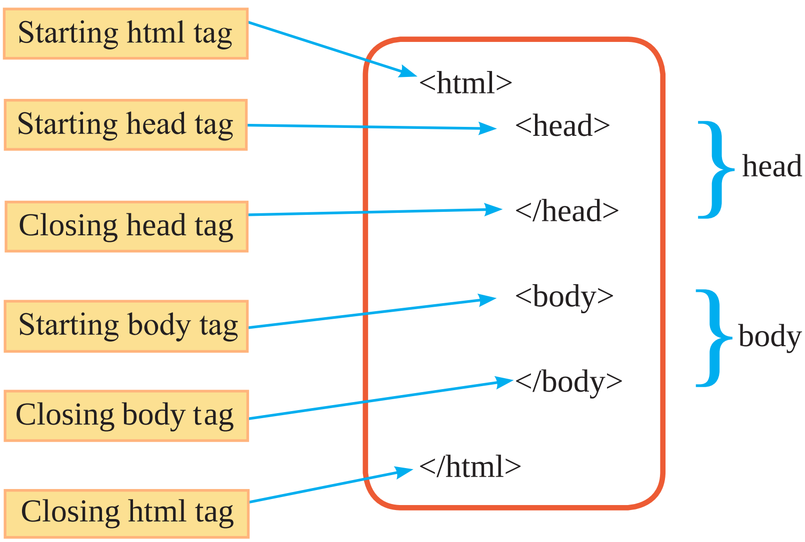


Figure 5.13 - Basic structure of a HTML document

An HTML document consists of two main parts; head and body. The figure 5.13 shows clearly that the opening <html> tag shows the opening of the document and the closing </html> tag shows the ending of the document.

Web page content should be included in the body part. Consider how you indicated "My first web page" in your first web page.

There are special occasions where you make notes in the Head part. For instance, consider again how you mentioned "This is the title" in <title> tag in your first web page. This is displayed on Title Pane which is at the top most of your web page.

5.1.9 Features of HTML

i) HTML tags show the web browser how the web page should be displayed. Such commands in an HTML document are called HTML codes.

ii) There should be a pair of angular brackets (< >) at the beginning and end of an HTML tag.

E.g. - <p> to mark the beginning of a paragraph

iii) Generally, HTML closing tags are given in pairs. "/" (back slash) with the name of the tag should be indicated in the ending tag.

E.g. - <p> to mark the beginning of a paragraph and </p> to mark the end of it

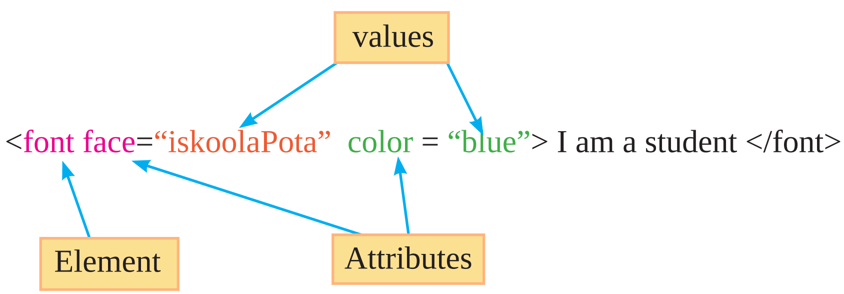
iv) Generally HTML tags are not case sensitive. That means, the use of capital or simple letters of the English language does not affect the meaning.

E.g. - <TITLE>, <Title> or <title> does not make any difference.

v) There will be no error messages if the tag is indicated incorrectly, however, the web browser will ignore that particular.

vi) There are three parts of an HTML tag – element, attribute and value.

E.g. - Following is the HTML code to display the plain text "I am a student" in Times New Roman font type in blue colour.



The features related to a certain HTML are indicated in the opening tag only and the values related to it are always indicated within inverted commas.

5.1.10 Designing a web page

Let us design a web page which gives a short introduction about "Sri Lanka" as given in Figure 5.14.

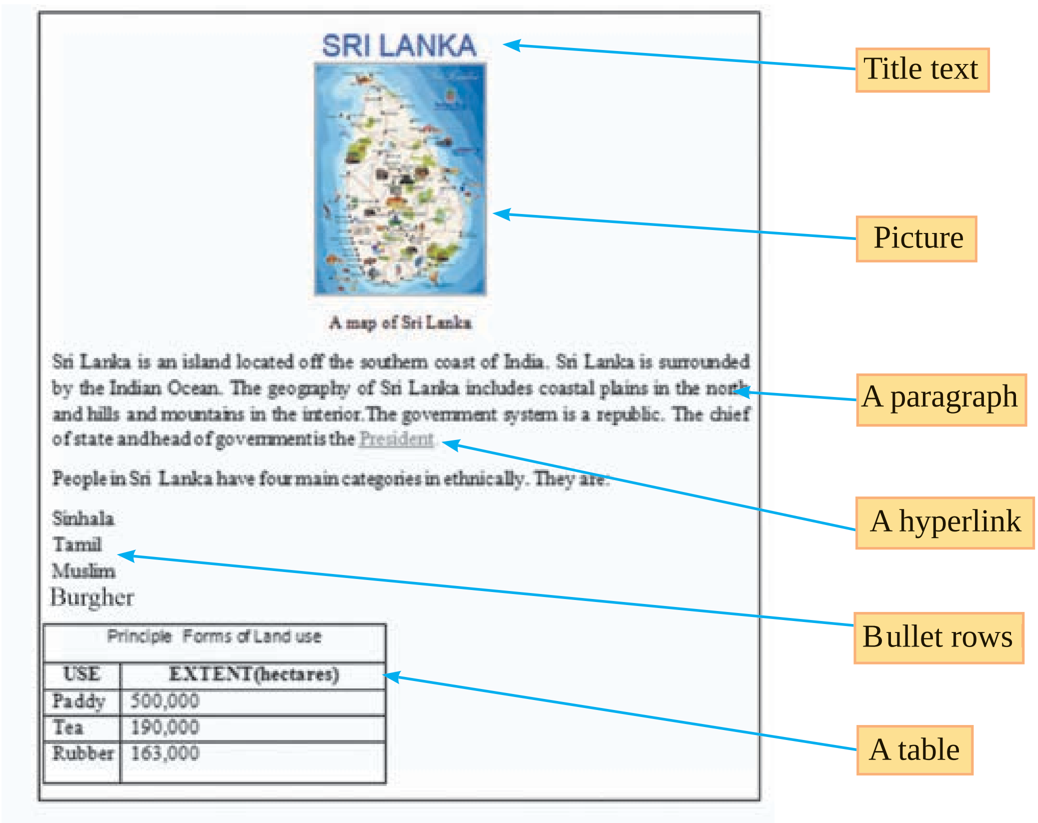


Figure 5.14 - A web page on a short introduction about Sri Lanka

Preparing the Title Text

Open a new web page using HTML editor. Then enter the HTML code as shown in the Figure 5.15. Save that web page in a folder in your computer and provide a suitable file name. Display the web page using a web browser and compare it with the output given in Figure 5.15 as well as the title text given in Figure 5.14.

```html
<html>
        <head>
                <title> Sri Lanka </title>
        </head>
        <body>
                <h2><center><font face="Arial" color="blue">
                                SRI LANKA
                                </font></center></h2>
        </body>
</html>
```

Header tag | Center tag | Font tag

Output: SRI LANKA

Figure 5.15 - HTML code to prepare the title text and its output

Let us consider the HTML tags further.

Header tag

Methods such as increasing the font size, making the letters bold etc are used to highlight elements such as headings, sub-headings and other texts from the rest of the document. For a web page, this is carried out using the tag called header. There are header tags from <h1> to <h6> in the order. Out of these, <h1> makes the letters the biggest and the bold. The size and the thickness of the letters are decreased gradually from <h1> to <h6>.

Instead of <h2> tag of your web page, use other header tags and adjust the title to a proper size, after checking how it is displayed on the web page.

Font tag

As you have learnt already, an HTML tag consists of three main components – element, attribute and value. There are three main attributes in the *Font* tag (ie. size, face and color). The font size attribute shows the size of the letters. For this, you can assign the values in the range from 1 to 7. Default is size 3. That is the size displayed automatically by the web browser when you do not assign a value to the Font size.

Font face attribute shows the type of letters. You can assign any type of letters available in your computer as its value. **E.g. -** "Ariel", "Verdana"

Font color attribute shows the colour of the letters. There are two ways to assign values for this.

i) Providing the names of the sixteen standard colours as they are, in Figure 5.16

Black	Gray	Silver	White
Yellow	Lime	Aqua	Fuchsia
Red	Green	Blue	Purple
Maroon	Olive	Navy	Teal

Figure 5.16 - Standard Sixteen Colours

Example: SRI LANKA

Output SRI LANKA

ii) Using RGB hexadecimal codes based on the basic colours red, green and blue, as shown in Figure 5.17.

The code is arranged here with six numbers from 0 to F preceding # sub feature. Here, the first two numbers represent the red, the next two numbers represent the green, and the last two numbers represent the blue.

Color	Color HEX
	#000000
	#FF0000
	#00FF00
	#0000FF
	#FFFF00
	#00FFFF
	#FF00FF
	#C0C0C0
	#FFFFFF

Figure 5.17 - Some RGB colour combinations

Example: SRI LANKA

Output SRI LANKA

Center tag

This is a tag used to align the title of your web page to the centre along the horizontal axis. This can be used not only for a text, but also for other elements such as a picture.

There are several tags like the Center tag which can be used to design texts. Given below in Table 5.1 shows some of them.

Table 5.1 - Text Formatting Tags

HTML symbol	How the letters are designed	Example
	Bold	**SRI LANKA**
<i>	Italic	*SRI LANKA*
<u>	Underline	SRI LANKA
<em>	Emphasis	**SRI LANKA**
<s>	strike out	~~SRI LANKA~~
<sup>	Superscript	SRI LANKA
<sub>	subscript	SRI LANKA
<marquee>	horizontally moving text	(Check this by applying to a web page)

Example: SRI LANKA

Output SRI LANKA

Refer following sites and study further about HTML tags used to design texts in web sites.

Example: http://www.w3schools.com/html
http://www.tutorialspoint.com/html

Activity



Design a web page using the name of your school instead of the school name given in the Figure 5.18. Use different designs you wish to add using Sinhala unicode font (“iskoola pota”). Change 'Encoding' as unicode in 'Save As' dialog box when saving the document (Figure 5.19). Compare your web page with the output shown in Figure 5.20.

```
<html>
<head><title> Text Formatting </title></head>
<body>
     <font face = "iskoola pota" color = "Green" ><h1> 1. name of your school  </h1></font>
     <font face = "iskoola pota" color = "lime" ><h2> 2. name of your school </h2></font>
     <font face = "iskoola pota" color = "olive" ><h3> 3. name of your school </h3></font>
     <font face = "iskoola pota" color = "Navy" ><h4> 4. name of your school </h4></font>
     <font face = "iskoola pota" color = "blue" ><h5> 5. name of your school </h5></font>
     <font face = "iskoola pota" color = "Aqua" ><h6> 6. name of your school </h6></font>
     <font face = "iskoola pota" color = "Teal" ><h6> 7. name of your school </h6></font>
</body>
</html>
```

Figure 5.18 - HTML document

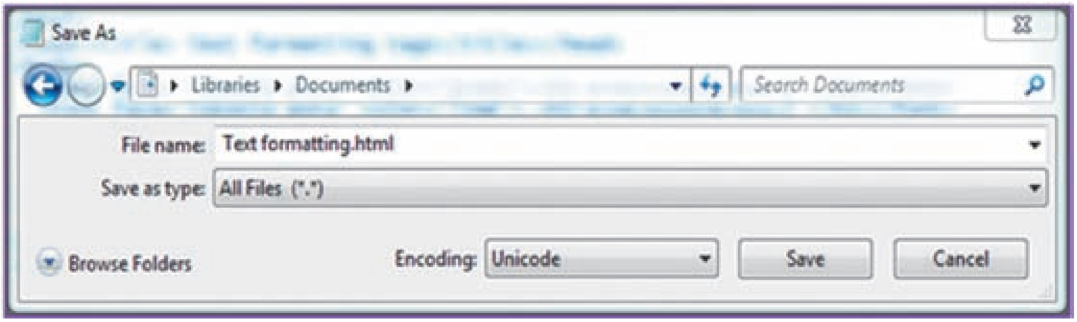


Figure 5.19 - Save as dialog box related to activity above



Figure 5.20 - Output

Activity

1. Find out other text formatting tags by referring to websites and books related to HTML codes and prepare a table similar to the Table No 5.1.
2. Design a web page using other text formatting tags instead of header tags given in Figure 5.18.
3. Study <marquee> tag further and design a suitable web page.

Inserting and formatting an image

Select a picture suitable to insert to your web page. When inserting images to a web page, it should be relatively low size file type such as .png , .gif or .jpeg. The images to be used in the HTML document can be saved in a separate folder.

Image tag

<img> tag, which is called the image tag, is used to link an image to a web page. This tag does not have two opening and ending tags. You will come across several such tags later which are called blank tags or empty tags. Though there are about 12 attributes related to the <img> element, only some important ones are explained in Table No 5.2.

Table No 5.2 - Some attributes related to <img> element

Attribute	Explanation about the value	Example
source or src	The image file name should contain the file extension also. If the image is in another folder, the relevant path should be given.	src="C:\Users\Pictures\pet.png"
alternative or alt	If the image given by the src attribute is not available in the text, that should be displayed image position indicated here.	alt = "map"
width	The width of the image to be displayed is indicated as the number of pixels or as a percentage of the size of the page.	width = "100" or width = "50%"
height	The height of the image is indicated as the number of pixels or as a percentage of the size of the page.	height = "100" or height = "50%"

border	If a border is needed around the picture, its thickness should be indicated as the number of pixels. Or else, indicate its vaule as “0”.	border = “3”
align	A suitable alignment value can be used among left, right, top, bottom, and middle.	align = “middle”

Example -

```
< img   src = "C:\Users\Pictures\srilanka.jpg"
alt = "Map" width = "100"  height = "200"
border = "3"  align = "middle" >
```

Output



Enter the code as in Figure 5.21 in order to insert the image to web page on Sri Lanka in section 5.10. Open the web page on web browser and compare it with the output in Figure 5.14.

```
<html>

<head><title> Sri Lanka </title></head>

<body><h2><center><font face="arial" color ="blue"> SRI LANKA
                    </font></center></h2>
                    <center><img src=" C:\Users\Pictures\srilanka.jpg"
                    ></center><center><font face="arial" size="2">
                    A map of Sri lanka  </font></center>
</body>
</html>
```

Output



Figure 5.21 - Code to enter the image and the output

Inserting and formatting a paragraph

To insert a paragraph below the image, insert the code given below in Figure 5.22 to the web page. Open the web page and compare with the output in Figure 5.23 and Figure 5.14.

```
<html>
<head><title> Sri Lanka </title></head>
<body><h2><center><font face="arial" color="blue"> SRI LANKA </font></center></h2>
        <center><img src=" C:\Users\Pictures\srilanka.jpg" ></center>
        <center><font face="arial"  size="2"> A map of Sri lanka  </font></center>
<p>  Sri Lanka is an island located off the southern coast of India. Sri Lanka is
        surrounded by the Indian Ocean. The geography of Sri Lanka includes
        coastal plains in the north and hills and mountains in the interior. The
        government system is a republic. The chief of state and head of government
        is the President. </p>
</body>
</html>
```

paragraph tag

Paragraph

Figure 5.22 - Insert a paragraph



Figure 5.23 - Output of code in Figure 5.24

Let us learn about the <p> tag further which is used as the paragraph tag.

Paragraph tag

The paragraph inserted using the <p> tag is left aligned by default. Four different types of alignments can be used on “left”, “right”, “center” and “justify” attribute in <p> tag.

Table 5.3 - Paragraph alignment

Example	Tag	Alignment
	< p align = "left" >	Left
	< p align = "center" >	Center
	< p align = "right" >	Right
	< p align = "justify" >	Justify

How to keep a gap between words

This is provided by using : tag which belongs to the the type of character entity tags.

<p> The government system is   a republic. The chief of state and head of government is   the President. </p>

Output

The government system is   a republic. The chief of state and head of government is   the President.

Activity

Identity some more tags which belong to the character entity type by referring to various websites or books related to HTML codes.

Inserting some rows

Enter the code given below in Figure 5.24 to your web page to insert some rows below the paragraph you entered in the third step.

```
<html>
<head><title> Sri Lanka </title></head>
<body><h2><center><font face="arial" color="blue"> SRI LANKA </font></center></h2>
          <center><img src=" C:\Users\Pictures\srilanka.jpg" ></center>
          <center><font face="arial" size="2"> A map of Sri lanka </font></center>
          <p> Sri Lanka is an island located off the southern coast of India. Sri Lanka is surrounded by
              the Indian Ocean. The geography of Sri Lanka includes coastal plains in the north and hills
              and mountains in the interior.The government system is a republic. The chief of state and
              head of government is the President. </p>
              People in Sri Lanka have four main categories in ethnically. They are,<br/><br/>
                        Sinhala<br/>Tamil<br/>Muslim<br/>Burghers
</body>
</html>
```

Line break tags

Figure 5.24 - Code to insert a few rows

Sri Lanka is an island located off the southern coast of India. Sri Lanka is surrounded by the Indian Ocean. The geography of Sri Lanka includes coastal plains in the north and hills and mountains in the interior.The government system is a republic. The chief of state and head of government is the President.

People in Sri Lanka have four main categories in ethnically. They are,

Sinhala
Tamil
Muslim
Burghers

Figure 5.25 - A part of the output related to the code given in Figure 5.24

The
 tag, which is called the line break to break lines, belongs to the type of blank tags/empty tags similar to the <img> tag you have used earlier. Identify that only
 tag is used exactly in the position where you need to break the line, without using two opening/ending tags.

Inserting Lists

When a number of related items are indicated in an order, it is called a list. Mostly, these items are indicated one below the other. There are three types of main lists in web page designing in the HTML language.

i) Unordered lists

 symbol is used to mark the beginning of an unordered list and the type attribute is used to show the shape of the special symbol with its element. Here are the three values which can be assigned to it.

1. Disc
2. Square
3. Circle

 tag is used to separate each item in the list.

```
<ul type = "disc"
      <li> Sinhala</li>
      <li> Tamil</li>
      <li> Muslim</li>
      <li> Burgher</li>
</ul>
```

Output

- Sinhala
- Tamil
- Muslim
- Burgher

Figure 5.26 - tag and its output

ii) Ordered list

A number of items arranged in order using numbers or letters are called an ordered list (Figure 5.27). Two tags - and <li>, are used together to indicate these in web pages.

Table No 5.4 - Values which can be assigned to <ol> type attribute and their meanings

Value	Meaning
1	Hindu Arabic numbers
A	English capital letters
a	English simple letters
i	Roman numbers with English simple letters
I	Roman numbers with English capital letters

Example -

```
<ol type = "I" >
      <li>Sinhala</li>
      <li>Tamil</li>
      <li>Muslim</li>
      <li>Burgher</li>

</ol>
```

Output

I. Sinhala
II. Tamil
III. Muslim
IV. Burgher

Figure 5.27 - Ordered Lists

iii) Description/definition list

Description lists are used to provide a description with the list (Figure 5.31)

Table 5.5 - Description list

Tag	Description
<dl>	Beginning of a description list
<dt>	Introduction of list
<dd>	Description of the list

Example: Write the HTML code as given below to display a description list as shown in Figure 5.28 in a web page and check the output.

```
<dl>
    <dt> Main subjects for the science stream </dt>
                                    <dd> Biology </dd>
                                    <dd> Physics</dd>
                                    <dd> Chemistry </dd>
                                    <dd> Combined Maths </dd>
    <dt> Main subjects for the commerce stream </dt>
                                    <dd> Economics </dd>
                                    <dd> Business Studies </dd>
                                    <dd> Accountancy </dd>
<dl>
```

Output

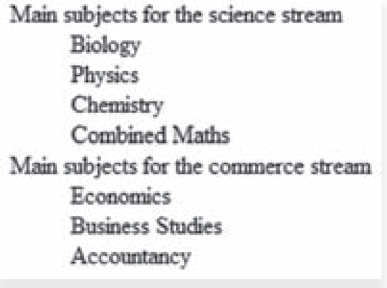

Main subjects for the science stream
    Biology
    Physics
    Chemistry
    Combined Maths
Main subjects for the commerce stream
    Economics
    Business Studies
    Accountancy

Figure 5.28 - Description list

Activity



Design web pages which contain lists as above using items you like.

4. It is possible to design web pages in a way that one type of a list contains another type of list. Given below is such a code and its output which is displayed in Figure 5.29. Build various forms of similar lists.

```
<ul type = "disc">
   <li>Sinhala</li>
   <li>Tamil
         <ol type = "1">
         <li> Sri Lankan Tamil </li>
         <li> Indian Tamil </li>
         </ol>   </li>
  <li> Muslim </li>
  <li> Burgher </li>
</ul>
```

Output

- Sinhala
- Tamil
    1. Srilankan Tamil
    2. Indian Tamil
- Muslim
- Burgher

Figure 5.29 - Coding of different lists and its output

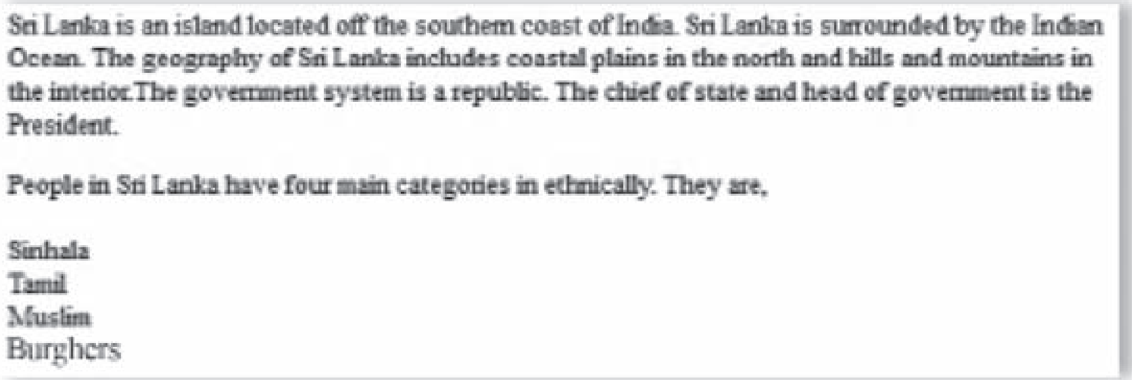
Hyperlink

Let us create a hyperlink for “President” as shown in Figure 5.14. Enter the code for it to your web page as given in Figure 5.30.

```
<html>
<head><title> Sri Lanka </title></head>
<body><h2><center><font face="arial" color="blue"> SRI LANKA </font></center></h2>
        <center><img src=" C:\Users\Pictures\srilanka.jpg" ></center>
        <center><font face="arial" size="2"> A map of Sri lanka  </font></center>
        <p>  Sri Lanka is an island located off the southern coast of India. Sri Lanka is surrounded
                by the Indian Ocean. The geography of Sri Lanka includes coastal plains in the
                north and hills and mountains in the interior.The government system is a republic.
                The chief of state and head of government is the
                <a href=”http://www.president.gov.lk“ >President.</a></p>
                People in Sri Lanka have four main categories in ethnically. They are <br/>
                   Sinhala <br/>Tamil <br/> Muslim <br/> Burghers <br/>
</body>
</html>
```

Anchor tag | href attribute | Attached file

Figure 5.30 - Creating a hyperlink for a text


Sri Lanka is an island located off the southern coast of India. Sri Lanka is surrounded by the Indian Ocean. The geography of Sri Lanka includes coastal plains in the north and hills and mountains in the interior.The government system is a republic. The chief of state and head of government is the President.

People in Sri Lanka have four main categories in ethnically. They are,

Sinhala
Tamil
Muslim
Burghers

Figure 5.31 - Output of the code related to the hyperlink

While displaying the web page, more the Mouse to the text "President" which contains the hyperlink.

The related file can be opened by double clicking on them or by giving the Open command after right clicking.

Anchor tag

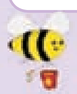
Hyperlinks can be created for a certain text or image by using <a> tag in HTML codes. There are some attributes related to this tag as well. The most important attribute which is href, shows the place which should create the link. If it is a file in the same folder which contains the web page, it is adequate to indicate the file name with the file extension.

Example: President
President

However, if it should be connected to another web page, the relevant path should be indicated accurately.

Example: President

Activity



1. Create a hyperlink to the picture of your web page with a suitable website in internet.
2. Prepare a list of attributes related to <a> tag by referring to websites or books on HTML codes.

Inserting a Table

Information such as various texts and pictures can be presented in a more organized way in rows and columns by including a table to a web page.

After the HTML code written using the
tag to include the four ethnic groups as Sinhala, Tamil, Muslim, Burgher in your web page, add the code as given in Figure 36 to include the table.

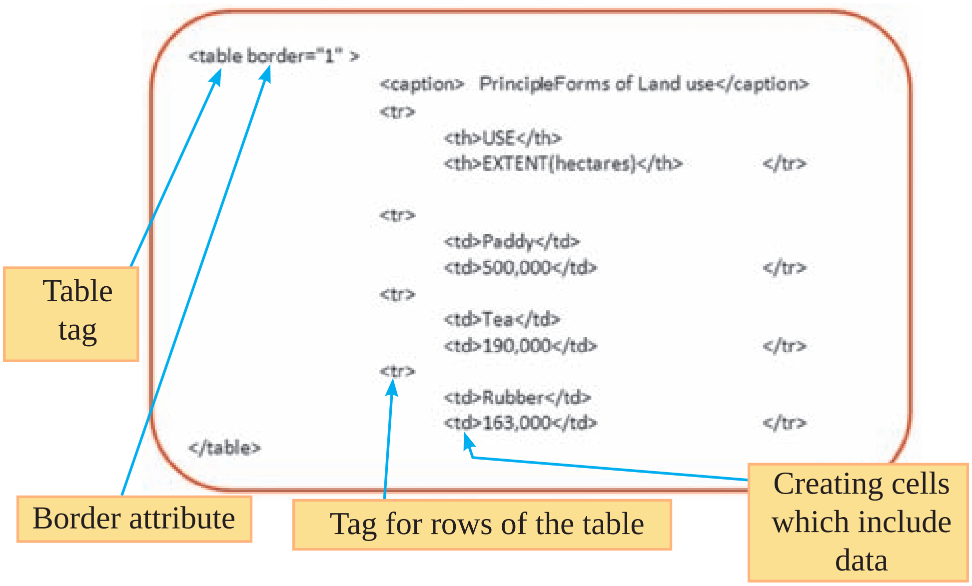
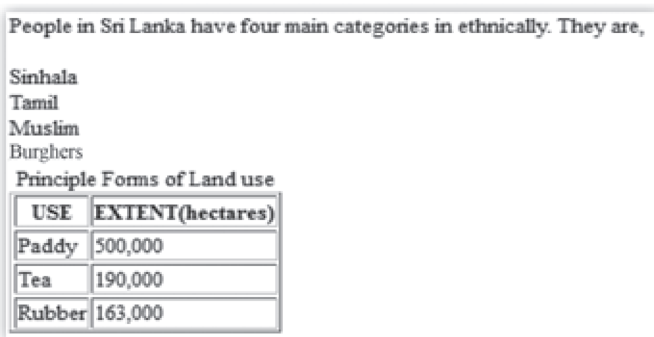


Figure 5.32 - Code to insert the table

Then display your web page and compare it with the output given in Figure 5.33 which indicates the relevant section only, as well as with Figure 5.14



People in Sri Lanka have four main categories in ethnically. They are,

Sinhala
Tamil
Muslim
Burghers

Principle Forms of Land use

USE	EXTENT(hectares)
Paddy	500,000
Tea	190,000
Rubber	163,000

Figure 5.33 - Output related to the code of Figure 5.32

Table Tag

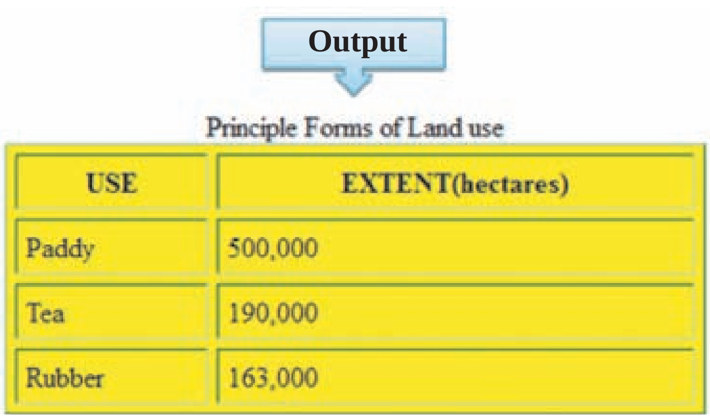
This tag marks the beginning of a table and the attributes to decorate the table are used with its element. Given below in Table No 5.6 are some of them.

Include these attributes to decorate your table.

Table 5.6 - Some attributes belong to <table> tag

Attribute	Explanation
align	Shows how the table should be aligned with the other texts in the page. Left, center, right are used as values.
width	Shows the width of a table as the number of pixels or a percentage of the width of the web page.
height	Shows the height of a table as the number of pixels or a percentage of the height of the web page.
bgcolor	Shows the background colour of the table. Values can be assigned in the same way colours were assigned to the texts.
border	"1" is used as the value if a border is needed around the cells of the table, if not "0" is used as the value.
boardercolor	Shows the colour of the boarder.
background	Used to include a picture to the background of the table. File name or the path related to the picture is used as the value.
cellpadding	Shows the gap between cell border and its content. value is indicated as a number of pixels.
cellspacing	Shows the gap between cells. Value is indicated as a number of pixels.

Example : <table border = "1"width ="400" height ="150"
cellpadding = "5" cellspacing = "5" bordercolor = "green" bgcolor = "yellow">



Principle Forms of Land use

USE	EXTENT(hectares)
Paddy	500,000
Tea	190,000
Rubber	163,000

Figure 5.34

Caption Tag

This tag is used to include a title or a description of the table above it. Even if there are no attributes, this caption can be decorated using the tags related to text decoration.

Example : < Caption><b><u>Principle Forms of Land use </ u></ b></ Caption>

<tr> Tag

This element, which is indicated as <tr>, adds a new row to the table. Just like in <table>, the attributes such as "align", "bgcolor", "border", "bordercolor" can be used differently for separate rows.

Example : <tr bordercolor = "green" bgcolor = "yellow" background = "image.png">

<td> Tag

Used to create cells to include data in a row. Just like for rows, attributes can be added separately for cells as well.

Example : <td width = "4" bordercolor = "green" bgcolor = "yellow" background ="image.png">

Sometimes, cells should be merged adding several rows or columns of the table. There are two attributes used for this.

1. **Colspan** - Used to create a cell merging several columns. The value of this attribute is the number of columns merged.

Example :

```
<table border="1">
<tr><td colspan="2"><center>LAND USE</center></td></tr>
<tr><td>USE</td>
<td>EXTENT(hectares)</td></tr>
<tr><td>Tea</td>
<td>190,000</td></tr>
<tr>    <td>Rubber</td>
        <td>163,000</td></tr>
</table>
```

output

LAND USE	
USE	EXTENT(hectares)
Tea	190,000
Rubber	163,000

Figure 5.35

2. **Rowspan -** Used to create a cell merging several rows. The value of this attribute is the number of rows merged.

Example :

```
<table border="1">
<tr> <th  colspan="2"> <center>  LAND USE </center> </th> </tr>
<tr>    <td> USE </td>
        <td> EXTENT(hectares) </td>      </tr>
<tr>              <td> Tea </td>
                  <td  rowspan ="2">  353,000 </td>        </tr>
<tr>     <td > Rubber </td>
</table>
```

<th> tag

output

<table>
<tr><th colspan="2">LAND USE</th></tr>
<tr><td>USE</td><td>EXTENT(hectares)</td></tr>
<tr><td>Tea</td><td rowspan="2">353,000</td></tr>
<tr><td>Rubber</td></tr>
</table>

Figure 5.36

<th> Tag

This tag, which is called the table header tag, is used to indicate the captions of the rows of table. However, this can be used instead of <td> tag related to any cell of the table. What is special about this is that the text in the cell will be bold. Including colspan and rowspan, all the attributes related to <td> tag can be used for this tag as well.

Activity

Create a web page which includes a table as given below. Make changes to the table using what you have learnt so far and understand thoroughly various tags related to creating tables and their attributes.

<table>
<tr><th>Column 1</th><th>Column 2</th><th>Column 3</th></tr>
<tr><td rowspan="2">Row 1 Cell 1</td><td>Row 1 Cell 2</td><td>Row 1 Cell 3</td></tr>
<tr><td>Row 2 Cell 2</td><td>Row 2 Cell 3</td></tr>
<tr><td colspan="3">Row 3 Cell 1</td></tr>
</table>

Create a website as your team has planned using a suitable HTML editor.

5.2 Web Designing Software

A sound knowledge of HTML language is essential in designing websites using simple word processors or HTML editors. Further HTML coding takes more time. Moreover, the basic HTML codes need changing for updates and alterations.

But, there are other web designing software which facilitate web designing quicker and more attractive. There the graphical user interface provides facilities to designing, editing, preview and upload. As per the concept WYSIWYG (What You See Is What You Get), you can create web pages in the same way you design them on the graphical user interface.

There are various types of web designing software. For instance,

1. Web authoring tools
2. Content Management Systems (CMS)

5.2.1 web authoring tools

The special feature of this type of web designing software is that the relevant HLML document is automatically prepared in a separate interface while the designer is finishing the web page using a graphical user interface. If the designer has knowledge of HTML coding, web page designing can be done using graphical user interface as well as HTML document.

There are many open source web editors such as Kompozer, Ckeditor, Bluegriffon which can be downloaded from Internet while there are lots of web editors like Adobe dream viewer, Microsoft front page, Visual studio that are to be purchased.



Figure 5.37 - Standard symbols of some open source web editors

Designing a website using a web editing software

Imagine that a website of six pages is planned to design on the topic "Various systems of human body". Figure 5.38 shows the structure, preview and the content of its Home Page.

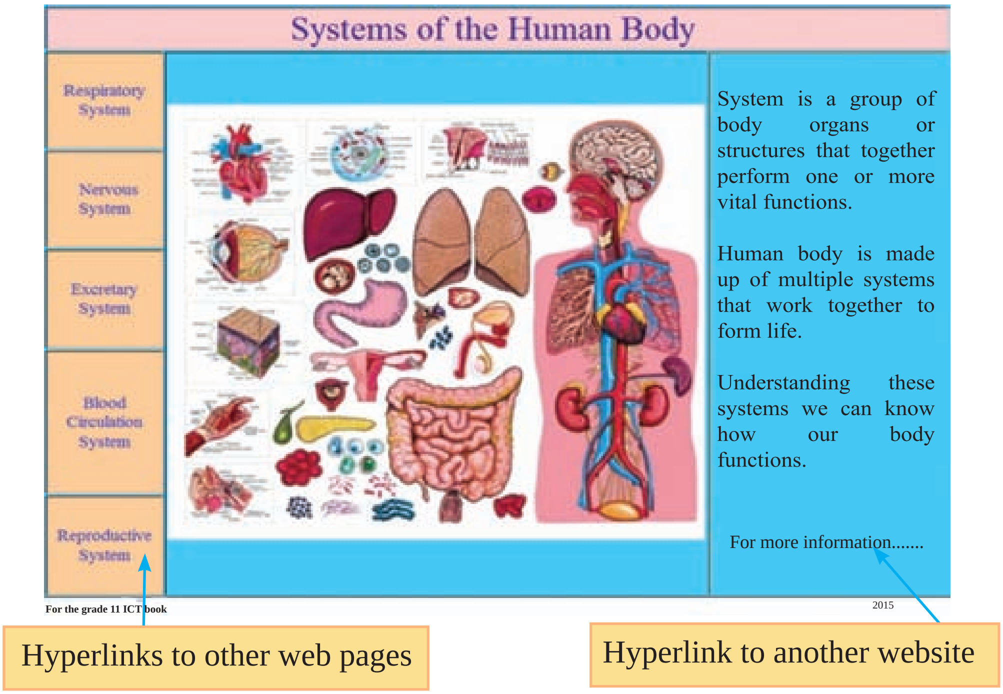


Figure 5.38 - Home Page

This home page contains the title, images of human systems, a short description, hyperlinks to the other five web pages and further details.

This website can be designed using any web designing software you prefer. The steps to design it using kompozer software are as follows.

Step 01 - Figure 5.39 shows the interface after installing kompozer. exe file in kompozer software (**E.g. -** www.kompozer.net/download-07.php).

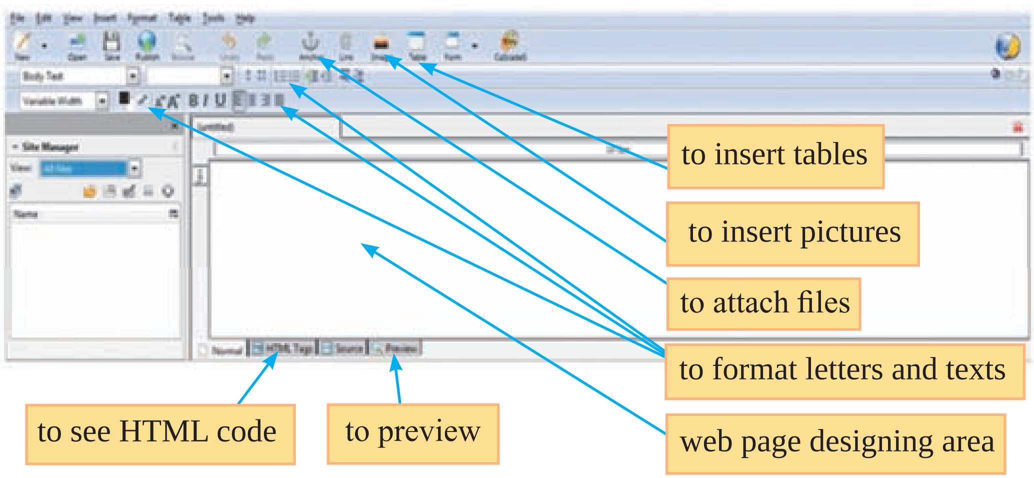


Figure 5.39 - Interface of Kompozer software

Step 02 - Type the title "Systems in Human Body" on the topmost in web designing area. Format the title by changing font, type, size, colour and background colour.

Step 03 - Using commands in File Menu, save it in a suitable folder with a suitable name. Preview your webpage using a web browser.

Step 04 - Though the image and other texts can be included as given above, use of a proper content layout makes the task easier.

Let us include a table for this. Get the Dialog Box given in Figure 5.40 using "Insert Menu" or "Table tool" in Menu bar.

Insert a table with 6 raws and 3 columns.

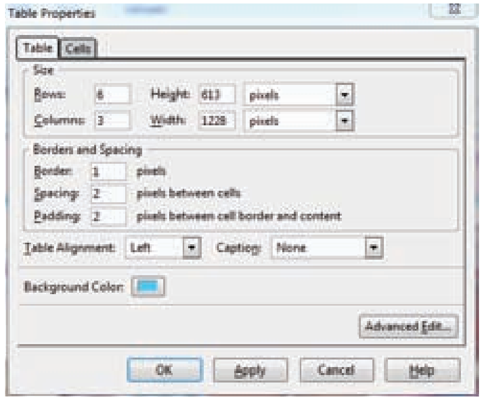


Figure 5.40 - Dialog Box to insert a table

Step 05 - As in word processing, the table can be formatted to change size of cells, insert, delete and merge cells. Format the table as in figure 5.41.

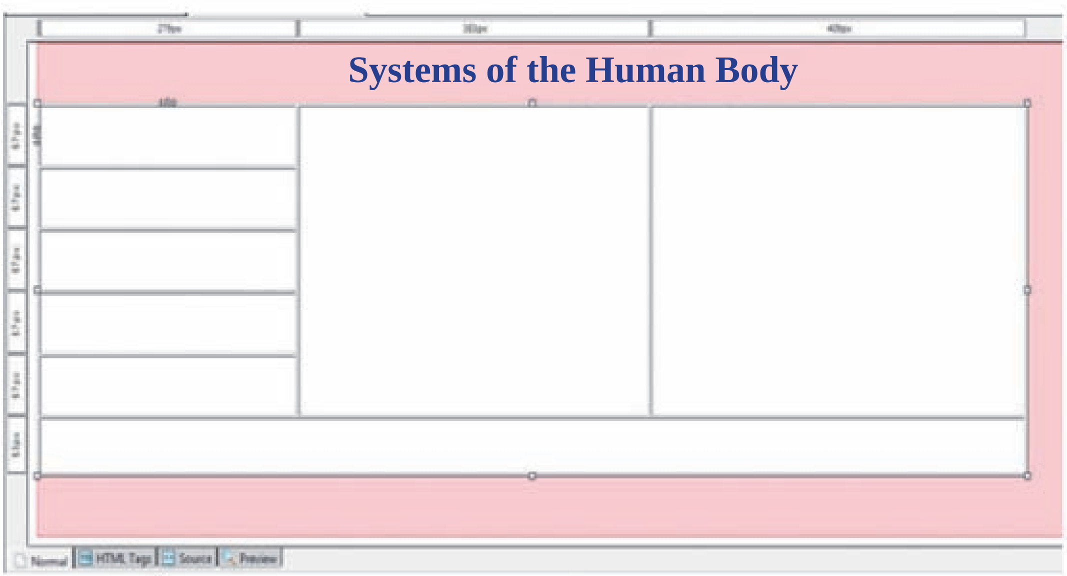


Figure 5.41 - Arrangement of cells in the table

Step 06 - Format the table including texts, images, hyperlinks as in Figure 5.39. It is easier if all the images used to design web pages are saved in one folder.

Step 07 - New pages can be opened using "New tool". Create separate pages for each system on the Home Page. Save these in the same folder using suitable names.

Step 08 - After forming hyperlinks to the relevant pages, preview the web page and format as necessary.

5.2.2 Static websites and dynamic websites

There are two types of websites according to the nature of its content as static and dynamic.

1. Static Websites

If the content of a website is maintained without any change over a period of time, such a website is called a static website. Normally, websites based on HTML language are static websites. Their structure and content are designed using HTML codes. The web content can be changed only by changing the code.

This kind of websites can be designed in a very simple way as a collection of a number of web pages. Users are not directly connected to the web server when using the websites. Only the designer of the website can enter the relevant changes by connecting to the web server where the website is hosted. These websites are safer even though it consumes more time for coding.

Websites that were created so far using word processing software, HTML editor, web editor etc are static web sites.

2. Dynamic Websites

If the web content is often changed, such a website is called a dynamic website. These are designed using software such as PHP (Hypertext Preprocessor), ASP.net (Active Server Page.net), JSP(Java Server Page). Here the web server generates information using a data base or program.

Example:

1. Current time is displayed as dynamic in a website.
2. Showing results of a candidate related to the index number.

Users are directly connected to the web server while using such websites. Information is exchanged from the user to web server or vice versa. Hence, the security of the website is threatened compared to a static website.

This is more appropriate for commercial, social or exam holding websites which should be often changed. However, higher knowledge and experience are required to build such websites in a protective way.

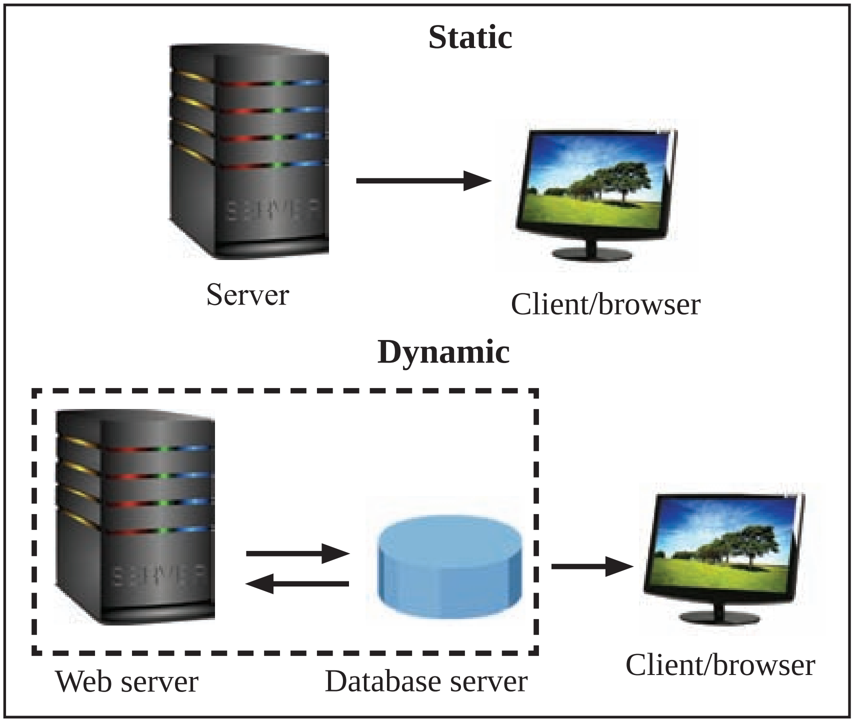


Figure 5.42 - Static and dynamic websites

5.2.3 Content Management Systems (CMS)

CMS can be defined as software used for dynamic website designing, content management and publishing. It is possible for the web designer to re-publish his website often changing its content.

Web designing and managing using CMS is very easy and fast, while no prior knowledge of computer languages is required. Hence, CMS is the most popular web designing tool at present.

The creativity of designing is limited to a certain range if various audio visual information is entered to the website using templates and wizards provided by the software. All the websites that are designed this way will be monotonous. This weakness can be largely avoided by changing relevant codes if you possess a sound knowledge of computer languages such as HTML, PHP, javascript, CSS, SQL.

Some open code CMS software with their web addresses are as follows.

1. Joomla (www.joomla.org/download.html)
2. Wordpress (www.wordpress.org/download)
3. Drupal (www.drupal.org/download)

How a website is designed using a CMS software

You can design this website using any CMS software you prefer and the steps to install "Joomla" software are as follows.

Step 01 - Install the three types of software given below in your computer. The web addresses required to download these are also given.

1. APACHE (www.apache.org)
2. PHP(www.php.net)
3. MySql (www.mysql.com)

However, it is easier to install a single package which includes all the above two such software are as follows.

1. WAMP (www.wampserver.com)
2. XAMPP (www.apachefriends.org/index.html)

Step 02 - Download Joomla software from www.joomla.org website and install it in your computer. Since there are lots of steps here, get necessary advice from a suitable website.

Example - https://docs.joomla.org/J3.x:Installing_Joomla

Step 03 - There is need to select proper templates, articles and components for a new website. Get necessary advice for this from a suitable website.

Step 04 - See the preview and do the necessary changes to your website.

Activity

Build the website your team planned using Joomla software.

5.2.4 Roles related to web designing

Designing a website for a certain institute and maintaining it while keeping it updated is a team work involving in many people. Each person has a role to play with the relevant tasks and many responsibilities. Let us identify some important roles among those.

1. **Author -** Designs interfaces of the website
2. **Editor -** Writes codes, checks errors and rectifies those.
3. **Publisher -** Fulfills tasks related to the publishing of the website.
4. **Administrator -** Fulfills maintenance tasks related to the web server and database.
5. **Users -** Use the website.

5.3 Publication of a website

Publication of a website includes the tasks such as designing website, hosting, updating and posting etc. There are several requirements a web publisher should fulfill for this.

1. A web designing software
2. A web host
3. A domain name
4. File transfer protocol
5. Internet connection

5.3.1 Web Host

The designed website should be hosted in a place where any person can access at any time from any place through Internet. Such service providing computers are called web hosts.

If the website is designed for a mass scale institute, normally they have their own dedicated host. If it is for a small scale institute, they get space from shared hosts maintained by other institutes. Shared hosts charge basic fee and annual charge according to the allocated capasity. There are many institutes in Sri Lanka as well as in the world which provide such web host services.

There are institutes which provide web host services free of charge as well. You can get this facility through various websites. Here, their advertisements are also displayed in your website.

Activity

Name two institutes which provide free web host services along with their relevant web addresses.

5.3.2 Domain Name

National identity number is given to each and every person in the world to identify a person uniquely.

In the same way, there is a system to find a website in the World Wide Web. It is known as ICANN (Internet Corporation for Assigned Names and Numbers) that bears the responsibility of assigning and administrating domain names for websites. After designing a website, it should be registered in that institute with a suitable domain name. Some of such other institutes are as follows.

1. www.godaddy.com
2. www.bluehost.com
3. ww.nic.lk

It is more appropriate to get registered paying a basic fee. Registration should be renewed paying an annual fee. Sometimes, it is done by the person who is responsible for hosting. However, if you need to host your website in another web host later, this can create issues on registration. Hence, it is more appropriate if the publisher himself registers the website.

Things to consider when selecting a domain name to a website.

1. It is appropriate to give a certain identification about the institute the website belongs to or the objective of preparing the website through the domain name. This makes the users easier to find the website through search engines.

   Example: The web address www.nie.lk indicates the institute the website belongs to the user by the domain name "nie".

2. According to the nature of the website, top level domain names such as ".com", ".edu", ".org",".lk" can be attached.

   Example: The top level domain name ".org" of the web address www.wikipedia.org indicates that it belongs to non commercial type websites.

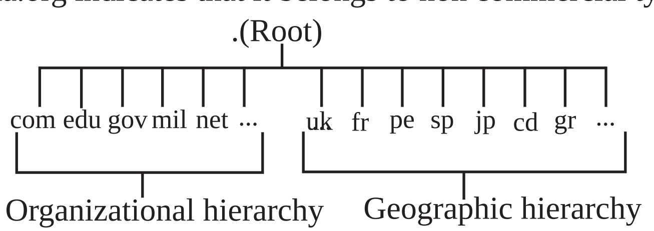


Figure 5.43 - Domain names of websites

3. If the domain name is short, it is easy for the user to remember it as well as to type it accurately.
4. It is not appropriate to include numbers, lines, in domain name. The reason for this is when the web address is read orally, it may not be communicated correctly to the listener.

Example:



Activity

Visit www.nic.lk and study the steps to obtain .lk domain name.

5.3.3 File Transfer Protocol/FTP

These are the software used to transfer the website you have designed to the selected web host according to the international standards. These can be purchased or downloaded free from Internet.

Example - 1. Filezilla (https://filezilla-project.org)
2. SmartFTP (https://www.smartftp.com)

Since most of the web designing tools include file transfer facility as well, another software is not needed. Further, the institutes which provide shared host services too provide the facility of file transferring.

5.3.4 Internet Connection

Internet connection is essential for the three steps of publishing a website – transferring, updating and path declaration. Internet connection is the medium which connects the users with the web host.

A proper Internet service provider should be selected to get Internet connection. Things such as the speed of the connection, charges, and maintenance services should be considered here.

Some Internet service providers in Sri Lanka are as follows..

1. Sri Lanka Telecom
2. Lanka Bell
3. Mobitel
4. Dialog Axiata

5.3.5 Maintenance of Website

Regular maintenance is an essential factor for the success of a website. This can be explained from several aspects.

1. Depending on the nature of the website, its content should be updated daily, weekly or monthly. Not only should the content of the website be changed here, but also the way it is presented, pictures, colours, shapes and other objects should be changed. By maintaining a column on the Home Page to publish new information, current changes can be updated instantly.
2. Harmful software like viruses, unauthorized access can create the website malfunction. Hence, regular attention should be paid, while getting back up time to time and proper security methods should be followed.
3. If there are new versions of the software used to design the website, website should be updated accordingly. It is important for the security of the website.

Activity

Publish the website your team has designed following proper steps.

Website designing and development process can be summarized as follows;

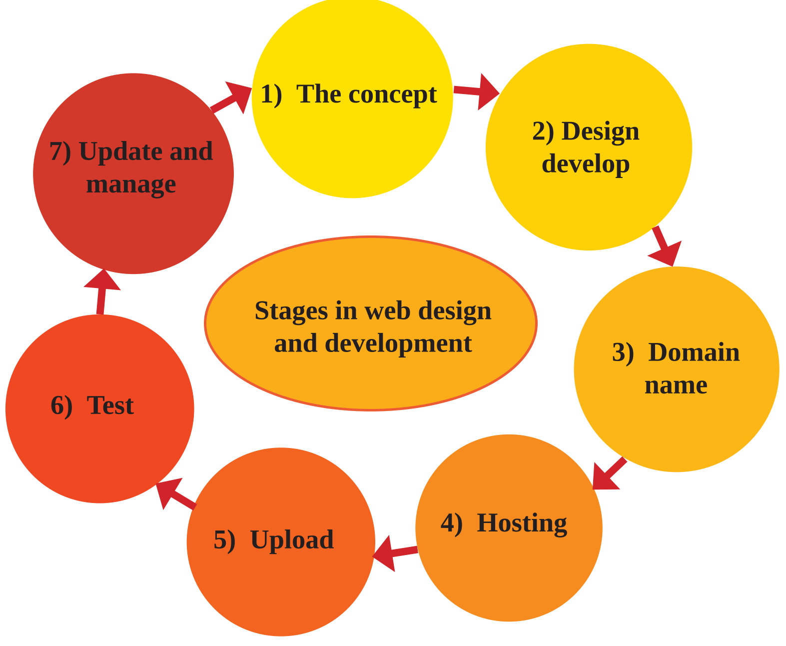


Figure 5.44 - Steps of web design and development

Summary

- In web designing, it is essential to design it with a structure and a pre design, and organize it well with the proper content which suits the needs of the users of the web site.
- Depending on the content, there are two types of web sites – static and dynamic.
- HTML is the basic language used for web designing. Knowledge of this language is essential to be a successful web editor. This makes writing HTML codes easier.
- Simple web sites can be designed even without any knowledge of HTML language, using the software such as web authoring tools and Content Management Systems.
- Dynamic web sites can be designed using Content Management Systems.
- A suitable web host, domain name, and a file transfer protocol should be selected to publish a designed web site.
- There should be a maintenance process for the success of a web site.

6 Information and Communication Technology and Society

After studying this chapter, you will understand the following:

- Contribution of ICT to entertainment
- Ethical and legal issues in ICT
- Precautions related to ICT infrastructure protection
- Health and safety issues inherent in the use of ICT

6.1 ICT in entertainment

Society is driven towards various forms of entertainment facilities for relaxation from everyday stress. However, most people prefer watching a film for relaxation. Unlike in the past, film producers nowadays enjoy the advantage of producing films of high quality with the use of ICT. Some of these modern facilities that film producers enjoy are as described below:

i) 3D – three Dimensional

With the use of advanced technologies producers can now make life look real on films using three dimensional technology.
To view films using 3D technology the user needs to use 3D spectacles available for the purpose.



Figure 6.1 - movies created by 3D technology

ii) Holographic image processing technology

A scene from a set shot in some place is recorded on camera. Holographic image processing technology is used to display this image elsewhere. This technology is mostly used with scenes depicting horror.

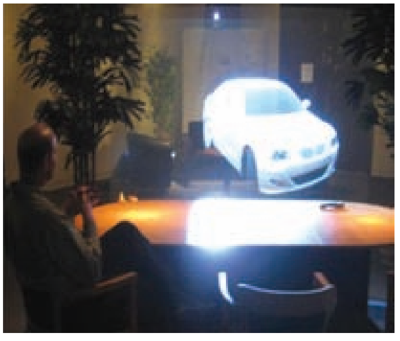


Figure 6.2 - Holographic image processing technology

iii) Cartoon films

Cartoon films are popular among both adults and the young. The 3D features and the development of technology in the relevant software have increased their attraction. (Fig 6.3)



Figure 6.3 - Cartoon films

iv) Digital audio materials

The use of the computer is evident with modern music and related editing. Recording of songs, creating rhythm and mixing are freely done using modern software to entertain audiences (Fig 6.4).

Songs recorded in this manner can easily be stored on compact discs (CDs) and other digital media.

It is also possible to listen to or view them using home theatre systems (Fig 6.5).



Figure 6.4 - Digital audio materials



Figure 6.5 - Home Theatre systems

v) Digital games

Digital games have become very popular today. Digital games can easily be played on computers or cell phones. Digital games in both 3D and 4D (four diamentional) are the most popular today.



Figure 6.6 - Digital games

vi) Simulation games

Simulation games are based on an everyday activity in a natural setting created artificially.

Simulation games are mostly used with training for sports activities, investigations, planning, military training, mercantile activities, and miming.







Figure 6.7 - Simulation games

6.2 Problems associated with the use of ICT

It is possible for Information Communication Technologies (ICT) to be mankind's closest friend providing many facilities to make life comfortable. Yet, with the use of ICT, mankind faces many unforeseen problems. These problems can be related to the following:

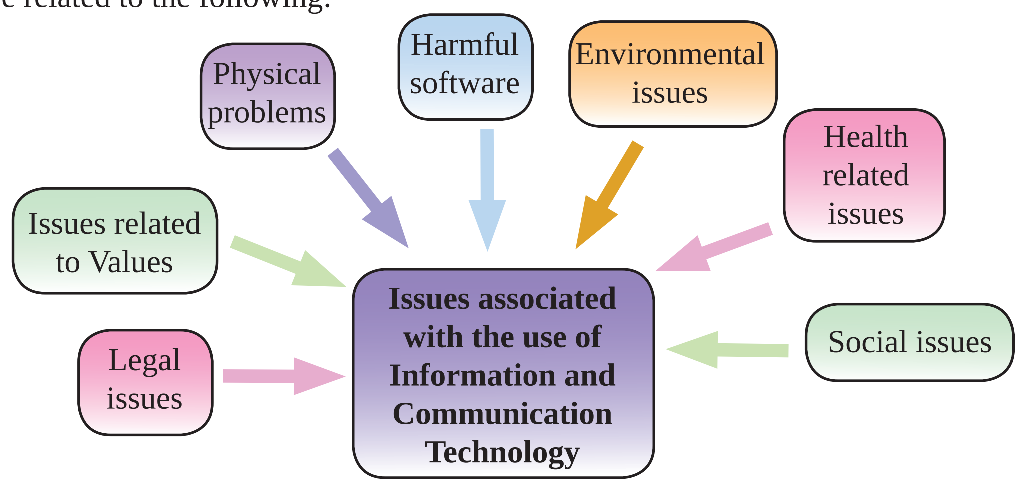


Figure 6.8 - Issues associated with the use of ICT

These issues and likely solutions are detailed in the following sub-section.

6.2.1 Legal issues

i) Data thefts -

Personally Identifiable Information (PII) stolen from a computer or other device can be considered as data theft.

E.g. - stealing or keeping flash drives, digital camera, mobile phones that contain personal names, telephone numbers, photos etc. without permission or legal rights.



Figure 6.9 - Data thefts

ii) Unauthorized access into computer systems -

It is possible to access computer systems unlawfully with the theft of or manipulating user name and password of a computer. An organization's data can easily be stolen in this manner.

iii) Intellectual property rights -

1. What are intellectual property rights?

Intellectual property usually relates to mind creations. Intellectual property rights relate to an innovation or a completely new product from a person or an organization currently. Such innovations or brand new products to enter the market are the property of the first person or organization to develop and release the product. They claim ownership to the innovation. It is their right to identify themselves as the legal or lawful owners.

Presenting such products in the names of others or using such products for other developments or sale of such products without the knowledge of the first person or organization is illegal. Such claims belong to the category of stolen intellectual property.

2. It is possible to obtain patent rights for protection of intellectual property.

A patent is a license issued by the State for innovations. To receive a patent license the innovator must apply to the national office governing patents.

iv) Fraud

Computer fraud is any dishonest misinterpretation of fact intended to let another to do or refrain from doing something which causes loss. The fraud will result in obtaining a benefit by, for example:

- Altering in an unauthorized way (e.g. employees entering false data)
- Altering, destroying, suppressing or stealing output to conceal unauthorized transactions

Identity theft: deliberate use of someone else's identity as a method to gain a financial advantage. (e.g. someone using another's Personally Identifying Information, NIC numbers, credit card numbers etc. without permission to commit fraud.

6.2.2 Issues related to values

i) Plagiarism

Plagiarism is the act of stealing another's creative work and displaying it as one's own. Plagiarism is very common among users of computers today with the stealing of data and other related information from the Internet.

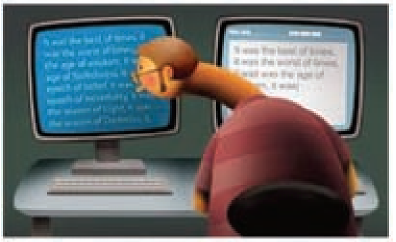


Figure 6.10 - Plagiarism

It is possible to use data and other information collected from the Internet in better accepted ways. Better accepted ways refer to the correct use of such collected information without in any way harming the reputation of the correct owner. This, can be done by,

1. citing - mentioning the rightful owner and his/her information.
2. quoting - the use of inverted commas ("…") to identify a selected or borrowed section.
3. referencing - the listing of resources from which the information was collected. This is usually done at the end of an essay or article.

6.2.3 Physical and logical issues

Computers need to be used carefully. Careless use of computers is likely to bring about both physical and logical issues.

Sudden power failures may lead to damaged computing devices. There may be computer thieves. It is also possible to experience a complete network breakdown with malware coming through the Internet. Environmental factors also contribute towards physical damage to computers.

If so, how can computers be made secure to free ourselves from physical and logical issues that are likely to arise?

➢ Physical Security

i) Uninterrupted Power Supply (UPS)

In case of an electricity breakdown, there has to be some alternate arrangement to supply power to the computer so that the network and the documents face no harm. Here, the alternate arrangement to supply comes with the battery contained in a UPS. This prevents interruption to the supply of power to the computer.(Fig. 6.11).

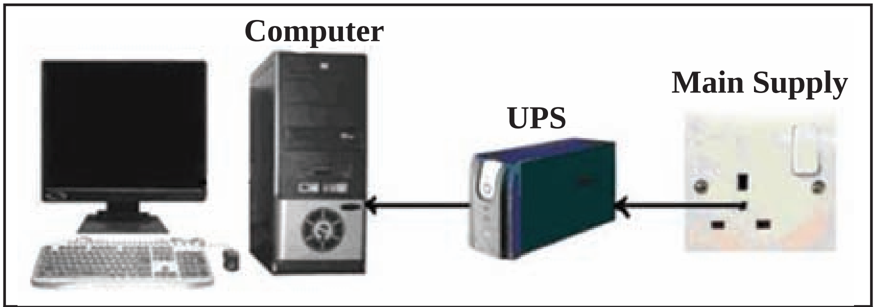


Figure 6.11 - Uninterrupted Power Supply (UPS)

ii) Hardware Firewalls

Hardware firewalls bought as a separate unit have now been built into broadband routers. Hardware firewalls are essential especially with computer networks connected to the Internet. A firewall protects a network from unauthorized access to or from a network by filtering data that pass through it. All messages entering or leaving a network pass through the firewall, which examines each message and blocks those that do not security criteria (fig. 6.12)

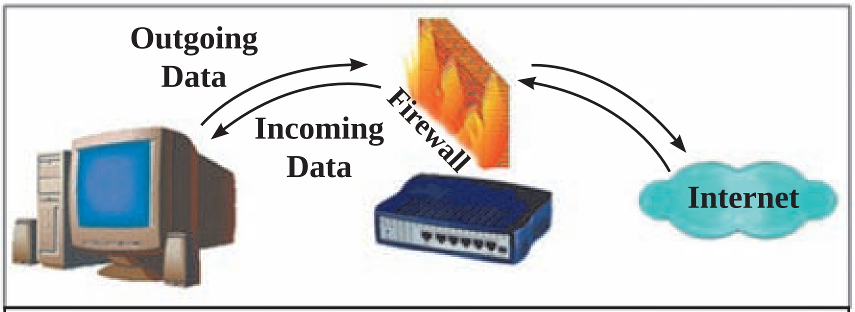


Figure 6.12 - Hardware Firewalls

iii) Controlled access through locked doors

Closed and locked doors are essential to ensure security of a computer laboratory. Closed and locked doors prevent or limit unlawful entry of people. It can also improve safety of computer systems and other accessories while protecting the information contained (Fig 6.13).

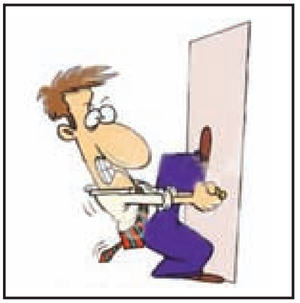


Figure 6.13 - Controlled access through doors

iv) CCTV

It is possible to install CCTV cameras inside a computer laboratory and monitor movement from outside or arrange for the day's proceedings to be recorded as a video clip for viewing later (Fig. 6.14).



Figure 6.14 - CCTV

v) Surge protector

The surge protector protects computers and other accessories inside a laboratory by controlling the voltage in the power supply. The local voltage supply for houses or offices is 230 V. The surge protector acts in situations where the power supply exceeds this limit, to control the destruction that could happen to electronic devices (Fig 6.15).



Figure 6.15 - Surge protector

vi) Environmental factors

Environmental factors can affect the proper function of a computer. Therefore, it is important to maintain a laboratory or a private computer in a safe environment free from dirt, dust, moisture and the like (Fig 6.16).



Figure 6.16 - Environmental factors

➢ Logical Security

i) Passwords

Passwords are used to secure data stored in a computer. Passwords protect unauthorized entry or use of a computer. In using a password, it is advisable to mix letters, symbols and numbers to make the password stronger. (Fig. 6.17)



Figure 6.17 - Passwords



Figure 6.18 - Software Firewalls

ii) Software Firewalls

Software firewalls are installed on a computer (like any software) and can be customized by the user. A software firewall will protect a computer from outside attempts to control or gain access to it (Fig. 6.18).

iii) Backups

In the event of a failure of a computer system, essential data and information in the computer can be lost. Therefore, a backup is essential towards securing protection of data and information. A backup can be maintained in an external hard disk, CD, DVD, a flash drive or a memory chip. It is also advisable to keep such backups securely in another physical location. (Fig 6.19)



Figure 6.19 - Backups

6.2.4 Malicious software / Malware



Figure 6.20 - Malicious software

i) The use of a computer involves various threats. Malicious software/Malware or malicious codes cause serious harm to computers and networks in many ways. Some examples of such effects are listed below:

- Decreased efficiency of the computer. (Improper function, unnecessary attempts or re-start again and again)
- Destruction or mal-function of software
- Inability to install other software
- Weaken computer hardware
- Sabotage of computer networks
- Data theft and destruction
- Reduction of the storage capacity of the hard disk by storing unnecessary documents and files.

Harmful software and resultant damage

A few types of harmful software and resultant damage are as described in the Table.

Harmful software	Resultant damage
Computer Virus	Computer viruses gain entry into the computer through a computer program and spread rapidly within the computer causing enough harm. Viruses can enter a computer through networks, a USB flash drive, external devices like memory chips, or through e-mail. Viruses enter the system as executable files. In other words the viruses always remain active within the computer.
Computer Worms	Computer worms also act similar to computer viruses. Worms, however, are capable of acting and spreading alone using e-mail attachments, false websites and instant messages.

Spyware	Trojan Horse The Trojan Horse is a harmful software based on the Greek Trojan Horse constructed using wood. It presents itself as harmless and enters the system without the knowledge of the user. Trojan Horse spyware makes the user uncomfortable by unnecessary opening up windows, producing different desktops, deleting documents and stealing data. Further, it allows other harmful software to gain entry. Trojan enters computer with e mail attachments. However, unlike computer viruses and worms, the Trojan Horse does not spread by itself.
	Adware The adware is displaying unnecessary notices on the computer screen. Using these advertisements, adware collects commercial information. Adware is not harmful as other computer viruses but disturbs the user mentally.
Bots	Bots are derived from the word 'robots'. Bots is harmful software that functions on its own communicating with other networks. Bots are used to collect personal information through Internet messages and conversations.
Hijacker/ Browser Hijacker	Hijacker/Browser Hijacker is capable of misdirecting a user to a different website through the Internet, to collect information regarding trade, commerce and advertisements. Hijacker, is similar to adware.
Phishing	Phishing is the art of deceiving users to collect information about bank accounts or electronic accounts. E-mail is used for the purpose. Such mail is sent through a popular organization or a friend together with a link for access. With a click on the link, or by filling forms, valuable information and cash deposits related to the unsuspecting user get stolen.
Spam	Spam is unauthorized e-mail. Most often, spam relates to advertisements about products or a mail from an unknown person. The mail box can get filled with such mail and make the user uncomfortable. Also, Spam may collect e-mail addresses that can be used unlawfully for frauds.

Safeguarding computer and a computer network from harmful software

- Install a virus guard into the computer. Update the virus guard as is necessary. Keep Guard/Shield/Auto Scan/Update always active.
- Be careful with the use of a USB memory. Check USBs for possible viruses using anti virus software.
- Always install authorized software
- Instead of an administrator account, maintain a user account

If the computer is connected to the Internet,

- Access secure websites. Check URL for verification.
- Select only secure websites for the download of software or other material.
- Before a download, check with a virus guard.
- Be careful with opening up e-mail. Where necessary use a virus guard before a downloading and attachment. Do not click on suspicious links in e-mail. Avoid opening suspicious e mails.
- Avoid suspicious advertisements or messages.
- Do not enter personal information without checking on security.
- Use firewall, virus guards, email filters to avoid the risk.

Some secure, popular virus guards to be installed on a computer are as follows.

- Avira Antivirus
- Avast Antivirus AVG Antivirus
- K7 Antivirus
- Digital Defender Antivirus
- Norman Antivirus
- Kaspersky Antivirus
- Panda Cloud Antivirus (B)
- Microsoft Security Essentials
- Norton Antivirus
- BitDefender Antivirus
- McAfee Antivirus

Prevention is better than cure

Activity



Make a list of virus guards from the Internet other than what is mentioned above. Tabulate the names of the manufacturer and the dates of manufacture.

Agencies in Sri Lanka responsible for the security of information exchange

There is hardly any individual or an organization in Sri Lanka who/which is not connected to the Internet. Over the last few years, unauthorized access into social networks, financial websites has been observed over the world. Sri Lanka is no exception. Therefore, the necessity for responsible agencies to secure Internet access has arisen. This is also called 'Cyber Security'.

Cyber security is not limited to e-mail, Internet solutions, or social networks. They are useful for personal networks and operating systems (OS). Some organizations responsible for cyber security are as follows.

- Institution for Information Security of Sri Lanka

Information and Communication Technology Agency (ICTA) is responsible for the establishment of this institution in Sri Lanka. It provides facilities to various organizations as listed below:

  - Citizens
  - Business establishments
  - State institutions.

- ICTA, Sri Lanka Standards Bureau and the Sri Lanka Emergency Computer Services have together organized to certify Information Security Management Systems (ISMS) to ensure security of information. Individuals and organizations can register for this.

Activity



Access the websites given. Make a list of computer related services you can obtain from them.

http://www.gov.lk/web/
http://www.engage.icta.lk
https://www.techcert.lk/si/
https://www.cert.gov.lk

6.2.5 Health issues related to use of Information Communication Technology

- Ergonomics and health issues

Ergonomics is a word made with the use of two words in the Greek Language. According to Greek Language “ergon” is job or action. “nomos” is law. Therefore, the simple meaning to be collected from this word is:

> “a job must be created to the comfort of the worker and the worker must not be forced to adjust himself/herself to the work. If not, the worker will subject himself/ herself to various tensions and illnesses.”

As of today, technology has become indispensable to mankind. Technology and mankind are now interconnected as inseparable. Daily, the numbers using technology keep increasing. As a result, technology related health issues too keep increasing. Issues arise as a result of the continuous use of a computer for over four hours at a stretch. Let us take a look at these health issues:

i) Musculoskeletal Problems

Non-stop use of a computer can bring about pain in different muscles and bones of the human system. The main reason for this is the wrong posture taken with the use of the computer (Fig 6.21).



Figure 6.21 - Musculoskeletal problems

ii) RSI – Repetitive Stress Injury

Repetitive stress injury is the pain extending from the shoulder to the fingers of the body. The affected areas can show swelling and hardness that brings out the pain. The difficulty to move the mouse is a result of this pain. The cause of the pain is incorrect posture (Fig. 6.22).

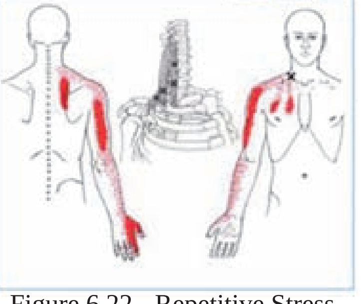


Figure 6.22 - Repetitive Stress Injury

iii) CTS – Carpel Tunnel Syndrome (Fig.6.23)

Carpel tunnel syndrome is the feeling of a numbness and pain in the fingers. The pain arises due to the pressure exerted on the wrist. Incorrect use of the key board and the mouse or placing them in the incorrect positions are reasons for the syndrome.

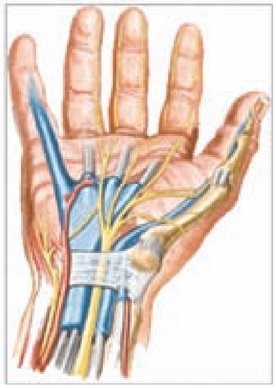


Figure 6.23 - Carpel Tunnel Syndrome

iv) CVS - Computer Vision Syndrome

Sticking to the computer continuously for 6 to 7 hours can cause irritation of the eyes and is identified as the Computer Vision Syndrome. Dry eyes, redness in the eyes, tearing, blurred vision, or pain in the head, neck or back are symptoms of the discomfort. (Fig.6.24)



Figure 6.24 - Computer Vision Syndrome

v) Headache

Pressure on the muscles of the neck and tiredness around the eyes usually cause headaches to users of computers. (Fig. 6.25)



Figure 6.25 - Headache

vi) Stress

Increase of activities in the working environment due to the technological advancement cause stress, sleeplessness, tiredness, lack of appetite etc. (Fig. 6.26)

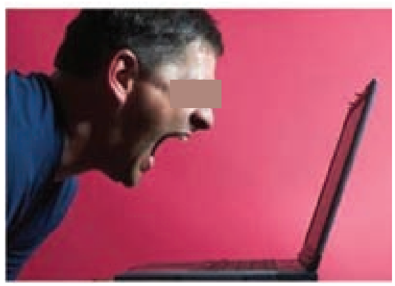


Figure 6.26 - Stress

How can these health problems be avoided?

Correct posture in the use of a computer, is essential. This is an essential feature of ergonomics.

Correct posture in the use of a computer can help prevent many problems associated with health. They are,

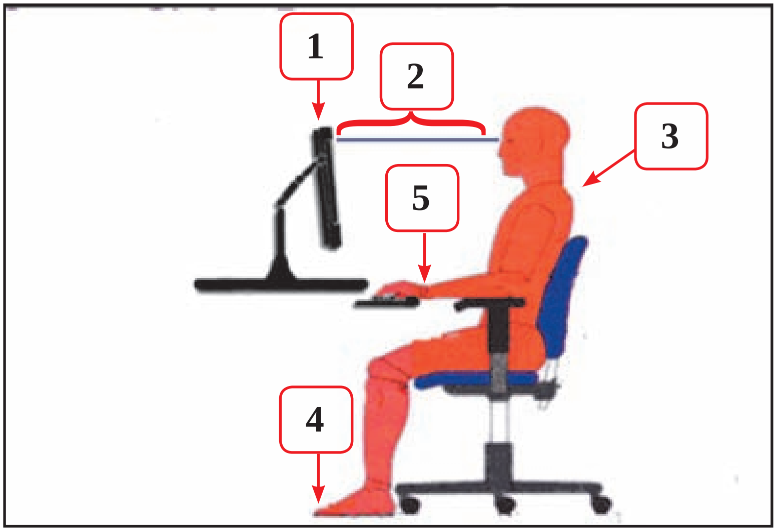


Figure 6.27 - Correct posture

1. Keeping the computer on a suitable table at eye level or a little lower.
2. The distance between the computer screen and the eye to be 18 – 28 inches or 45 – 70 cm.
3. Keeping the user's back straight against the back of the chair and keeping shoulders relaxed.
4. Keeping legs vertical to the ground with the soles flat on the surface.
5. Keeping the mouse near the computer, keying in words lightly, moving wrist as is necessary while keeping the keyboard straight at elbow level or lower.

To adhere to these movements:

- Adjust light on the computer to make the eyes comfortable
- Blink and take eyes off the screen on and off
- Take a break in between work, walk short distances
- Fix playtime sessions for children and direct them to other activities
- People using computers at work for 7 to 8 hours need to refrain from using computers at home and maintain a relaxed mind.

Followers of these procedures are unlikely to face health issues.

6.2.6 e waste - Harmful elements and effects on environment

Electronic products such as computers, television, mobile phones, printers worked using electricity or powered by batteries have become non working after reaching the end of their useful life are known as e waste. (Figure 6.28)

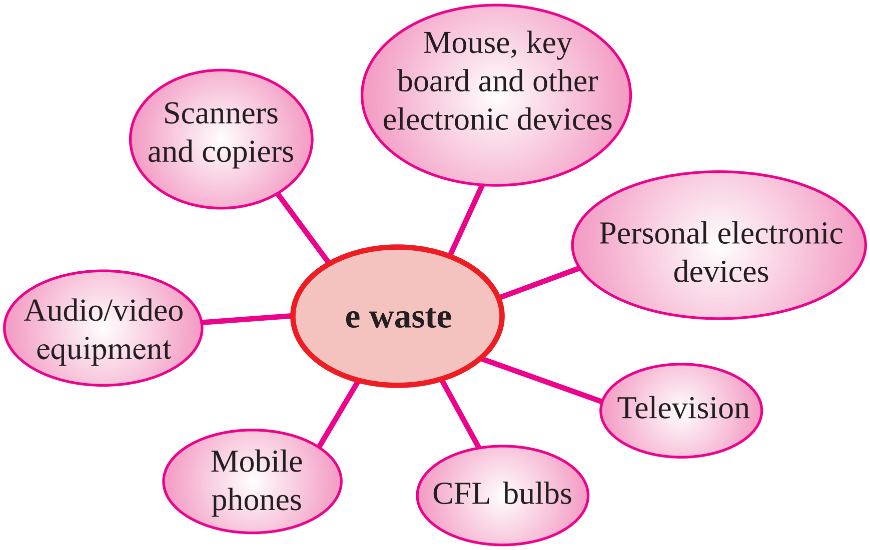


Figure 6.28 - e waste at the end of the useful life

These productions are made up of lots of harmful elements. Once the useful life is over and discarded to the open environment without following the correct procedure of disposal, it causes immense harm to humans and the environment as well. Pollution of the environment effects man himself.



Figure 6.29

If CFL (compact fluorescent light) bulbs are disposed in an improper way, it can harm the environment since they contain minute particles of mercury, a toxic metal that is hazardous.

Health hazards and effects of Mercury

- Damage to brain cells
- Disruption of the nervous system
- Allergies on the skin
- Once inhaled, Mercury vapour can harm kidney, liver and central nervous system
- Damage to DNA (Deoxyribonucleic Acid) and chromosome

Further, the improper disposal of other e waste can cause swelling and irritation on the body, nausea, stress, issues in blood veins and cancers.

some such harmful elements are,

Arsenic, Barium, Beryllium, Cadmium, Chromium, Dioxins, Lead, Mercury, Selenium

Proper disposal of e waste

1. Reduce usage - Reduce unnecessary purchase by maintaining the existing electronic devices
2. Reuse - Sell or donate old but working electronic devices without discarding
3. Recycle - Directing irreparable devices to an institute which recycle them

Activity



1. Visit the website of Central Environmental Authority of Sri Lanka and identify the steps that are taken for e waste disposal.
2. Visit www.ewaste.lk, the institute dedicated to the proper disposal of e waste in Sri Lanka. Prepare a booklet containing the services provided by that institute and how these services are obtained.

6.2.7 Social issues related with ICT

i) Digital divide

Digital divide is an economic and social inequality due to the differences in access to, ability to or use of Information Communication Technology.

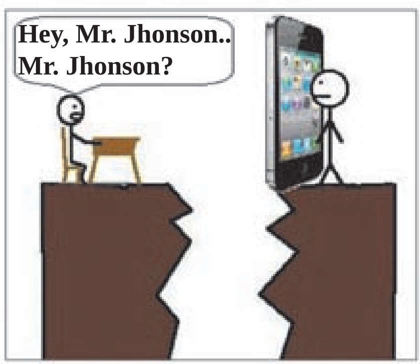


Figure 6.30 - Digital divide

Some of the reasons for the digital divide are as follows;

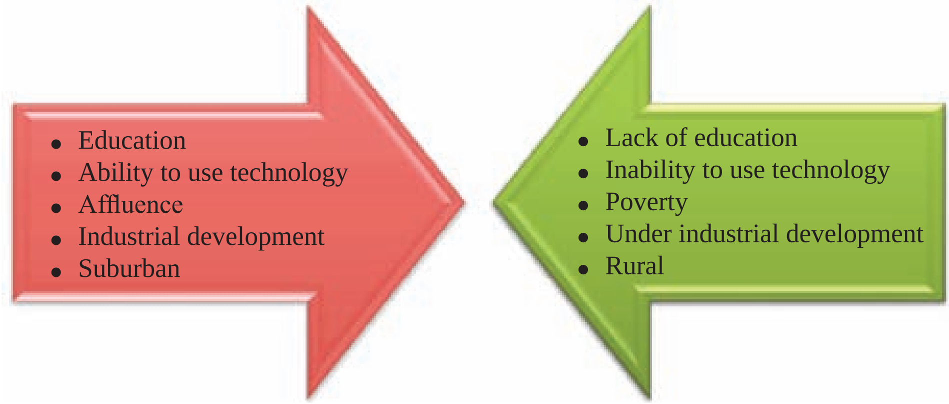


Figure 6.31

- **Education/Lack of education** - Ignorance regarding the benefits of Information Communication Technology and their use create differences among individuals.
- **Availability/Unavailability of technical know-how -** There is little possibility of connection between people who are knowledgeable of and make good use of Information Communication technology with those who are totally ignorant of Information Communication Technology or their uses.
- **Affluence/Poverty -** Even though, there is a need and the necessity to learn and use ICT, afford ability becomes a matter for denied.
- **Industrial development/under industrial development -** Industrialization of a country is a reason for the use of Information Communication Technology. Non-industrialization leads to a digital divide between countries.
- **Suburban/Rural -** Those leading urban lives are very busy and use Information Communication Technology heavily. On the other hand, those leading simple lives freely in rural areas simply do not care for the use of Information Communication Technology. As a result, there arises a digital divide between people.

ii) Digital Bridge - Digital bridge is forming connections among people avoiding the digital divide. However, it is not possible to create a digital bridge by providing each and everyone with a computer or a mobile phone. It is necessary for people to acquire different technological products, get to know them and learn how to use them effectively. Otherwise, the technology may become meaningless and lose value.

How to form a digital bridge



Figure 6.32 - Digital Bridge

- Digital Literacy – Acquiring ICT Knowledge helps get over a digital divide. Establishing places such as, Vidatha centres, Nenasala centres, Computer Resource Centers to provide free use of computers or at low cost in different parts of the country, can contribute towards overcoming a digital divide. To promote the use of such centres, there need to be mobile publicity, delivery of handouts and poster displays.

The benefits of digital literacy are as follows:

  - Realization of the need of using ICT resulting in an urge to use it
  - Helps overcome issues arising from the use of ICT as far as possible.
  - Realizes the value of using the Internet for payment of bills, doing research and collecting information about education, being aware of information related to modern medicine and in applying for jobs.

- **Supply of computers -** Digital literacy is the foundation of the digital bridge. Organizing the purchase of computers at easy concessionary rates can increase the literacy rate in a country. It helps not only those anxious to gain digital literacy but also other members of such families as well.
- **Equal opportunities to dispel other financial difficulties -** Making it possible for everyone to access the Internet for free on a reasonable payment and clearing all obstacles towards this process. Easy access to the Internet for everybody will certainly help school children of all ages to collect necessary information for their study purposes while making online education possible. It will also provide opportunities for employment, observe market trends, exchange information through social networks and related concerns.

- **Participation of intermediaries -** To make the digital bridge a success, it is extremely necessary to get the support of various business concerns, people's associations and both public and private sector sponsorship and assistance.

Activity



Find what measures the Sri Lankan government has taken to get over the digital divide and establish a digital bridge.

iii) De-Skilling

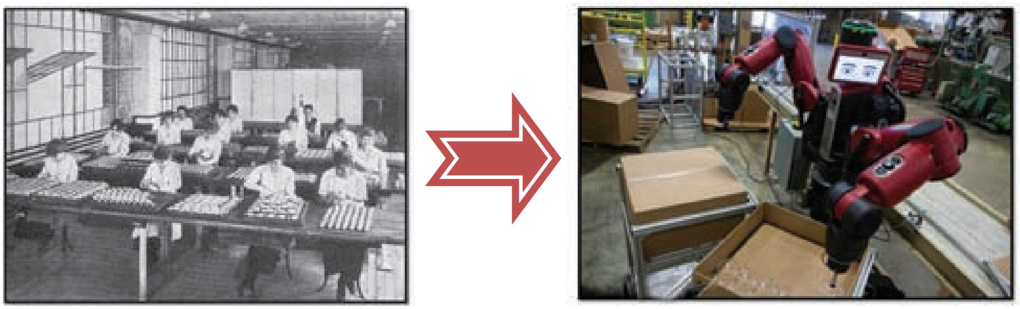


Figure 6.33

De-skilling is also one of the effects of using ICT. (Fig. 7.33) Machinery or automation has taken over skilled labour in places of work, driving people away towards unemployment. It is easy to direct and maintain machinery at work. However, the chances lost by skilled workers are enormous and have made them helpless.

People and organizations have a wealth of knowledge collected over the years. All this knowledge is wasted with the shift to machinery. Further, the change does not allow for more knowledge and allows for lost opportunities. These contribute to the disadvantages of automation.

A few such examples are discussed below:

- Machinery has taken over the industry replacing the talents of people.
- Libraries have been made to close down and jobs in the sector lost due to the electronic books and magazines.
- Online learning through the distance mode has limited teacher resources.
- Health concerns are easily sorted out from home itself, cutting down the job opportunities in laboratory services

Technology related employment opportunities



Figure 6.34 - Technology related employment opportunities.

We learnt that technology would, in various ways deny us opportunities for employment. (Fig. 15.34) Yet, technology has, today, come to be an invaluable asset to mankind. The main reason for this is the availability of sufficient opportunities for employment to those aware of ICT

Some high level, prosperous and well paid employment opportunities for those with knowledge of and the ability to handle ICT are listed as follows. There are many more opportunities other than for those listed.

- Computer programmer
- Computer/Information Systems Analyst
- Data Communications Analyst
- Database Programmers and Analyst
- Desktop/Applications Support Specialist
- Mobile Application Developer
- Network and Systems Security Specialist
- Network Managers and Administrator
- Software Engineer
- Technical Sales Specialists
- Technical Trainer
- Telecom manager
- Telecommunications Line Installer
- Website Developers

But of these, Software Engineers are the most in demand, locally and globally. At present, Software Engineers employed abroad have come to be the largest contributors towards foreign exchange earnings. This is due to the Software Engineers being a highly paid employment opportunity. Therefore, being highly educated about the development of software as well as ICT can certainly help you win prosperity with highly paid employment opportunities.

6.2.8 Misuse of ICT to harm Society

i) Social Media

Social media could be introduced as a fertile breeding ground towards connecting people globally, cultivating associations and grouping like-minded people towards exchanging personal information and opinions on related topics of interest. Given below are a few services social media provide.



Figure 6.35 - Social Media

- Promote one's products profitably
- Blogs – Blogs are a shortened term for We**b log**s and refer to routing personal diaries or magazines. These web logs are created for people to present their daily experiences or about happenings that could cause harm to society. On reading web logs others too can contribute opinions.
- Social media helps attract people using the Internet to one's own website, product detailing websites or blogs.
- Forum – Forums are routine discussion panels. Forum provides a good opportunity for people to openly express common opinion. Forum is another service from social media.
- It has become increasingly possible for social media to connect people from different parts of the globe share opinions, participate in lively discussions, exchange images, video clips, and songs.

ii) Cyber crime

However, irresponsible use of social media has engendered misconduct in society. This irresponsible use is identified as cyber crime. A few such acts are as described.

- Uploading others' images without permission
- Releasing unsuitable photographs or videos of women or young girls to the Internet and making use of such images or videos to frighten, threaten or blackmail
- Giving publicity to information that can harm a person's reputation
- Misleading people with wrong information and images about others published on the Internet to cause personal discomfort
- Using social media to give out false information and, thereby attract others to finally destroy lives
- Using unfair means to gain access to others' personal accounts and stealing personal information.

iii) How can we protect ourselves from using social media?

- Be careful in selecting social media over the Internet
- Be cautious about making friends through social media over the Internet
- Be careful in presenting personal information to social media over the Internet
- Avoid accessing suspicious e-mails
- Do not click on suspicious links that come through e-mail
- Ignore anonymous e-mails
- Do not allow social media to access the e-mail address book
- Do not use personal e-mail to access social media
- Avoid installing applications in your computer that come through social media.
- Think twice before using social media
- Make little children and friends aware about the harm social media can cause.

Summary

- Technology is used in various ways to entertain.
- The use of the Internet brings up issues. They relate to legal, ethical and physical issues, harmful software, environmental, health and the social.
- Patent rights help secure legal rights of intellectual property.
- To avoid physical issues interrupted power supply, hardware firewalls, closed circuit TVs restricted entry through locked doors, surge protectors can be used.
- Logical issues are best met with passwords, making firewalls active and maintaining backups.
- Harmful software can come in as computer viruses, computer worms, spyware, bots, hijackers, phishing and spam.
- It is safe to use antivirus software for protection against harmful software.
- Physical strain can be minimized with correct posture.
- Electronic waste needs to be disposed of correctly to avoid unnecessary harm to the environment.
- Digital divide is a social issue arising from ICT.
- Digital bridge can help avoid digital divide.
- ICT contributes towards elimination of inherent talent.
- Those quite knowledgeable about ICT have an advantage over others in well paid employment.
- Safe use of social media can help minimize cyber crime